Health Building Note 28
Facilities for cardiac services
2nd ed 2006

STATUS IN WALES
SUPERSEDED

This document was replaced by HBN 01-01 Cardiac facilities 2013

For queries on the status of this document in Wales, please contact NWSSP – Specialist Estates Services: info@whe.wales.nhs.uk or phone +44(0) 29 2090 4084

Status Note created July 2016
PLEASE NOTE

HBN 28:2006 *Facilities for cardiac services* was a Department of Health document adopted in Wales with the following notification attached:

Your attention is drawn to the following:

- No mention is made of the use of the MHRA document *Medical Electrical Installation Guidance Note (MEiGan)* which, although currently under review, should be specified as a requirement and applies to most areas of the Cardiac Services Department.
  
  [www.mhra.gov.uk/](http://www.mhra.gov.uk/)

- In particular, there will be a requirement to provide Isolated Power Supplies (IPS) and UPS units in many areas not specifically mentioned in the HBN.

- There will be a need in some treatment areas, such as Catheter Rooms, to consider the provision of sufficient emergency lighting (additional to escape lighting) to allow investigation work to be completed or terminated in the event of a mains or local circuit failure.

- The inclusion of entertainment and telephone services to bedhead services, paragraphs 13.49 to 13.51, should be the subject of consultation since it may be unnecessary in such short term bed areas.
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This document gives best practice advice on the design and layout of new cardiac facilities within acute hospitals. The recommendations should also be applied, where practical, when existing facilities are being upgraded.

The document covers facilities for undertaking non-invasive and invasive cardiac investigations and treatments, including electrocardiography and echocardiography, coronary angiography and electrophysiology, insertion and testing of implantable devices (including pacemakers, implantable loop recorders and implantable cardioverter defibrillators), and cardiac surgery.

Key legislation affecting the provision of cardiac facilities is highlighted.
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Appendix 1 – References

Appendix 1 – References
1 Introduction

Purpose and scope of the document

1.1 This document gives best practice advice on the design and layout of new cardiac facilities within acute hospitals. The recommendations should also be applied, where practical, when existing facilities are being upgraded.

1.2 It provides detailed design guidance on the following:

- dedicated out-patients unit (for provision of consultation/examination and patient support/information services);
- non-invasive investigations unit (for undertaking electrocardiograms (ECGs), blood pressure monitoring, echocardiography, and analysis of pacemakers and other implantable devices);
- catheter laboratories and associated facilities (for undertaking invasive cardiac investigations and treatments and implanting devices);
- minor cardiac procedures room (as an alternative to a catheter laboratory for implanting devices, except complex devices);
- dedicated day case unit (for admission, preparation, recovery and discharge of day patients undergoing invasive procedures);
- cardiac operating theatres and associated facilities, where these differ from standard operating theatre suites.

1.3 It replaces the existing Health Building Note 28 – ‘Facilities for cardiac services’ (2001 edition).

1.4 This document covers facilities for treating congenital cardiac disorders as well as acquired heart disease.

1.5 Children with congenital disorders who undergo any form of interventional procedure should be cared for in an environment tailored for children (Kennedy Report 2001). This may take the form of a dedicated children’s cardiac unit or designated children’s facilities within a cardiac unit treating both adults and children. Where a dedicated children’s unit is provided it should be located close to adult cardiology services.

1.6 Regardless of the model of care, in-patient accommodation for children should always be separate and dedicated (see paragraphs 2.13–2.14 and paragraphs 2.21–2.22 for details).

1.7 It is appropriate to treat adolescents (16–18-year-olds) in the same clinical spaces as those used for treating adult patients, although consideration should be given to running dedicated clinics for this patient group. In-patient accommodation for adolescents should be separate and dedicated (see paragraphs 2.13–2.14 and paragraphs 2.21–2.22 for details).

1.8 Any unit treating children and/or adolescents should provide facilities for parents and families, including overnight accommodation. This should not jeopardise the security of the unit.

1.9 The needs of patients with learning difficulties and multiple health problems should be considered.

1.10 See ‘Friendly healthcare environments for children and young people’ (NHS Estates 2003) for guidance on creating appropriate and secure environments for juveniles.

Background information

1.11 Coronary heart disease (CHD) is the most common cause of premature death in the UK, as well as a significant cause of ill health and disability.

1.12 Each year, CHD accounts for the deaths of 110,000 people in England, of whom more than 41,000 are under the age of 75. Approximately 300,000 people each year have a heart attack, and CHD accounts for about 3% of all hospital admissions.
1.13 Services for diagnosing and treating CHD are a priority for the Government and are the subject of a National Service Framework (NSF) document. This includes a chapter on arrhythmia and sudden death.

1.14 Congenital abnormalities of the heart occur in approximately 0.8% of live births (that is, 8 in every 1000 live births), ranging in complexity from minor anomalies, which require specific treatment, to those where only palliative therapy is possible.

**Supporting guidance**

1.15 The British Cardiac Society (BCS) has produced guidelines on current and future requirements for clinical cardiac facilities in acute settings (based on requirements per million people). See ‘Clinical and laboratory cardiac facilities required in the UK’ (BCS 2004) for further details.

1.16 The BCS guidance should be used by those planning to build new acute cardiac facilities to help gauge their individual requirements. However, it should be noted that it excludes facilities for conducting resting and ambulatory ECGs and ambulatory blood pressure recording (as it is assumed that these investigations will be conducted at primary care level) and does not include facilities for treating congenital disorders.

1.17 Furthermore, it does not include requirements for catheter laboratories but rather includes requirements for laboratories for specific invasive investigations and treatments, many of which may be undertaken in a catheter laboratory.

1.18 The British Society of Echocardiography (BSE) has operated an accreditation system for adult echocardiography since 1994 and specifically for departments since 2004. For further details see the BSE ‘Departmental Accreditation’ document (available via http://www.bsecho.org). This includes recommendations for sizes of echocardiography rooms, together with equipment and engineering requirements. Those planning echocardiography facilities for adults should refer to the accreditation document.

1.19 The British Cardiac Congenital Association (formerly the British Paediatric Cardiac Association) produced some recommendations in 2002 for therapeutic cardiac catheterisation in congenital heart disease. These ‘Guidelines’ can be accessed via the BCS website (http://www.bcs.com). Those planning catheter laboratories for paediatric use should refer to the BPCA guidelines.

**Activity DataBase**

1.20 The Activity DataBase data and software assists project teams with the briefing, design, specifying and procuring of the healthcare environment:

- 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;
- schedules of equipment/components are included for each room, which may be grouped into ergonomically arranged assemblies;
- schedules of equipment can also be obtained at department and project level;
- fully-loaded drawings may be produced from the database;
- reference data is supplied with ADB that may be adapted and modified to suit users’ project-specific needs.

1.21 For further information, see http://www.adb.dh.gov.uk.
2 Planning considerations

Introduction

2.1 This chapter describes cardiac care services within acute hospitals. It identifies services that are best provided as dedicated or designated cardiac services and those that may be provided centrally as part of a shared service.

2.2 Where services are shared, any adaptation for cardiac care use is highlighted.

Cardiac care services

Consultation/examination and patient support/information services

2.3 Consultation/examination and patient support/information services may be provided from a dedicated out-patients unit (see Chapter 3 for details).

Diagnostic services

2.4 Non-invasive cardiac investigations may be carried out in a dedicated unit (see Chapter 4 for details).

2.5 Coronary angiography and electrophysiology studies will usually be undertaken in a catheter laboratory (see Chapter 5 for details).

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 Volume 1 – ‘Facilities for diagnostic imaging and interventional radiology’ for details).

2.7 Where congenital cardiac disorders are treated, consideration should be given to locating cardiac MRI facilities within the unit itself rather than in the main imaging unit.

2.8 Pathology services will usually be provided from a central pathology facility (see Health Building Note 15 – ‘Facilities for pathology services’ for details).

2.9 Where investigations involve an element of recovery, patients may be admitted to a day case unit (see Chapter 7 for details).

Treatment services

2.10 Aside from surgery, most invasive cardiac treatments will be undertaken in a catheter laboratory (see Chapter 5 for details), although insertion of implantable devices (other than complex devices) may take place in a minor cardiac procedures room (see Chapter 6 for details).

2.11 Patients will need to recover following treatments. This will usually take place in a day case unit (see Chapter 7 for details).

Surgical services

2.12 Cardiac surgery is undertaken in designated operating theatres. See Chapter 8 for special design requirements of cardiac operating theatre suites.

In-patient services

2.13 In-patient accommodation for cardiac patients does not differ from in-patient accommodation for other patient groups and comprises surgical and medical wards. There should be separate, dedicated cardiac wards for children, adolescents and adults.
2.14 See Health Building Note 4 – ‘Accommodation for in-patient services: options for choice’ (under review) for details of adult accommodation. See also Health Building Note 23 – ‘Hospital accommodation for children and young people’. The latter covers overnight accommodation for parents and families, and education and learning facilities.

High dependency care areas

2.15 Coronary care units (CCUs) are required for the continuous monitoring of patients suffering from cardiac abnormalities or acute cardiac emergencies, such as acute myocardial infarction (AMI).

2.16 A CCU may also accommodate patients not stable enough to return to a cardiac ward after an invasive procedure and/or patients requiring an initial assessment.

2.17 CCUs will not normally accommodate patients requiring artificial respiration. Exceptionally, patients referred from other hospitals for admission to critical care (that is, with artificial respiration) will be admitted on a temporary basis to a CCU.

2.18 Ideally, emergency referrals of patients with confirmed or strongly suspected AMI will be made directly to a CCU. Direct ambulance access should be provided where feasible. If the CCU is not at ground level, dedicated lift access is recommended.

2.19 CCUs are most commonly associated with cardiac wards or critical care areas (CCAs). If the latter, the CCU may share core support services and facilities with the CCA.

2.20 The CCU should also be conveniently close to a minor procedures room, other medical wards, cardiologists’ offices, catheter laboratories, cardiac operating theatres and accident and emergency (A&E).

2.21 Where congenital cardiac disorders are treated, dedicated high-dependency beds for this patient group should be provided. Beds for children and adolescents should be located on the children’s or adolescent cardiac wards as appropriate.

2.22 The revision of Health Building Note 4 will include facilities for high-dependency care. See also ‘High dependency care for children: report of an expert advisory group for Department of Health’, 2001 for further guidance on treating children.

Facilities for immuno-compromised and infectious patients

2.23 The need to protect immuno-compromised patients from infection, and to contain infection from patients who are themselves infectious, will require the provision of isolation facilities equipped with special ventilation systems to achieve positive or negative room pressures relative to the surrounding areas (see Health Building Note 4 Supplement 1 – ‘Isolation facilities in acute settings’ for details).

Critical care areas

2.24 Critical care areas (CCAs) for cardiac surgery patients do not differ from CCAs for other patient groups. There should be separate, dedicated CCAs for children, adolescents and adults with direct access to cardiac operating theatres. See Health Building Note 57 – ‘Facilities for critical care’ for details. See also ‘Paediatric intensive care: a framework for the future’, 1997 for further guidance on treating paediatrics.

Rehabilitation services

2.25 Cardiac patients may require access to a gymnasium for the purpose of rehabilitation. This will usually be provided from a central rehabilitation facility. Access to an outdoor walking circuit is desirable. For guidance on the design of rehabilitation facilities see Health Building Note 8 – ‘Facilities for rehabilitation services’.

Mortuary services

2.26 These will be provided as part of a central mortuary service. For guidance on the design of mortuary accommodation see Health Building Note 20 – ‘Facilities for mortuary and post-mortem services’.

Pharmacy services

2.27 Pharmacy services will usually be provided from a central pharmacy facility (see Health Building Note 29 – ‘Accommodation for pharmaceutical services’ for details).
3 Out-patients unit

Introduction

3.1 This chapter lists the components of a dedicated out-patients unit (OPU) for cardiac patients. Alternatively, these facilities may be provided from a central out-patients department.

3.2 For design guidance on the listed components see Health Building Note 12 – ‘Out-patients department’. Any variation for cardiac patients is highlighted.

3.3 Ideally, the OPU should be adjacent to the non-invasive investigations unit (see Chapter 4 for details). It should be close to other diagnostic facilities, including diagnostic imaging and pathology (the latter may be achieved by use of a pneumatic tube) and to a pharmacy.

Components

3.4 A dedicated OPU for cardiac patients may comprise the following:

- reception desk;
- waiting area;
- WCs for patients, escorts and staff, including an accessible WC;
- nappy changing and baby/infant feeding facilities;
- buggy/pushchair parking;
- children's play area for children accompanying adult patients;
- refreshment facilities;

Consultation and examination room, Leeds General Infirmary (courtesy of Leeds General Infirmary Medical Illustration Department)
• telephones;
• patient lockers;
• area for undertaking physical measurements;
• combined consulting and examination rooms, some of which should be designated for paediatric use, and decorated appropriately, if children attend the unit;
• multidisciplinary consultation/examination room, where patients with congenital disorders attend the unit;
• venepuncture cubicles;
• interview rooms for private discussions/counselling;
• clean utility room for storage of clean and sterile supplies, including controlled drugs storage;
• dirty utility room for urine testing, cleaning of used items and temporary holding of items requiring reprocessing or disposal;
• disposal hold for items awaiting collection for disposal or recycling;
• housekeeper’s room;
• staff rest room;
• staff changing rooms, including provision of lockers and showers.

3.5 The waiting area may contain patient/relative information services in the form of leaflets and support group booklets. A plasma screen or similar may be used for displaying information. Consideration should be given to a display of contemporary art.

3.6 All patient areas should have access to a resuscitation trolley (with defibrillator), a mobile suction unit and a cylinder of oxygen on a trolley.

3.7 Requirements for office accommodation and meeting rooms should be determined locally.

3.8 A decision on the need for a medical records store should be taken locally.

3.9 Where a dedicated children’s OPU is provided, consideration should be given to providing echocardiography facilities en-suite or integral to the consulting/examination rooms.
Introduction

4.1 Ideally, this unit should be adjacent to the OPU with which it may share many facilities, for example, reception and waiting facilities and many of the support services listed in Chapter 3. The following list of requirements is based on this assumption.

4.2 It should also be close to the catheter laboratories and cardiac operating theatres.

4.3 The purpose of this unit is to investigate cardiorespiratory status using:

- 24-hour ambulatory blood pressure monitoring;
- resting, stress and ambulatory electrocardiograms (ECGs);
- resting, stress and transthoracic echocardiograms;
- ECG and continuous blood pressure monitoring, whilst tilting patient at an angle (tilt test);
- analysis of implantable devices.

4.4 The number of ECG and echocardiography rooms will depend on the workload of the unit, including whether investigations for congenital cardiac disorders are undertaken. See ‘Clinical and laboratory facilities required in the UK’ for requirements for acquired cardiac disease.

4.5 Where children attend the unit, a number of ECG and echocardiography rooms should be designated for paediatric use and decorated to appeal to children. These rooms need to be able to accommodate the whole family, including siblings, and allow space for pushchairs.

Components

Patient changing rooms

4.6 Patients may need to undress/change before undergoing exercise ECGs or echocardiography.

4.7 Patient changing facilities should comprise separate lockable changing rooms for patients to change in privacy. Separate storage for clean and used gowns should be provided. Shower facilities should also be available.

4.8 Ideally, changing rooms should be adjacent to stress ECG rooms and/or echocardiography rooms.

Resting ECG rooms

4.9 Each room should be able to accommodate a patient and relative or chaperone, cardiac physiologist, and occasionally a cardiologist. The patient may be ambulant or on a bed/trolley.
4.10 It will also need space for trolley-mounted ECG equipment, a free-standing, fully-adjustable couch offering all round access to the patient, and a computer workstation for the cardiac physiologist.

**Stress ECG rooms**

4.11 Each stress ECG room should be able to accommodate a patient (ambulant) and relative or chaperone, two cardiac physiologists (or one cardiac physiologist and a medical practitioner), and occasionally a cardiologist.

4.12 It will also need space for the equipment listed in paragraph 4.10, with the addition of a treadmill or exercise bike (for exercise stress), trolley-mounted sphygmomanometer (for blood pressure measurement) and stands/pumps for administering drugs (for pharmacological stress).

**Holter fitting rooms/cubicles**

4.13 Facilities are required for fitting patients with Holter leads and recording packs (for the purpose of undertaking ambulatory ECGs and 24-hour blood pressure monitoring). Each fitting room or cubicle will need to accommodate a height-adjustable chair. Storage space for equipment will need to be provided.

**Echocardiography rooms**

4.14 Each room should be able to accommodate a patient and relative or chaperone, an echocardiographer and occasionally a cardiologist. The patient may be ambulant or on a bed/trolley.

4.15 It will also need space for trolley-mounted echocardiography equipment and a free-standing, specialist echocardiography fully-adjustable couch offering all-round access to the patient.

**Stress echocardiography rooms**

4.16 Each room should be able to accommodate a patient (ambulant) and relative or chaperone, two echocardiographers, and occasionally a cardiologist.

4.17 It will also need space for the equipment listed in paragraph 4.15, with the addition of a treadmill or exercise bike and trolley-mounted 12-lead ECG monitor and recorder, sphygmomanometer and stands/pumps for administering drugs.

**Transoesophageal echocardiography rooms**

4.18 Each room should be able to accommodate a patient (ambulant) and relative or chaperone, two echocardiographers, and occasionally a cardiologist.

4.19 It will also need space for the equipment listed in paragraph 4.15, with the addition of a sphygmomanometer, pulse oximeter (for blood oxygen level measurement) and storage cupboard for the probes. The couch should provide head-down tilt for use when sedating patients (to clear an airway in the event of the patient vomiting).
4.20 A separate recovery bay, located in an adjacent space, will be required for recovery of sedated patients.

4.21 Children undergoing transoesophageal echocardiograms (TOEs) require a general anaesthetic. The procedure is therefore usually performed in a catheter laboratory.

4.22 Where TOEs are performed on children within the non-invasive unit, nitrous oxide and active anaesthetic gas scavenging will be required in the TOE room.

Interview room

4.23 A separate interview room, close to the echocardiography rooms, will be required if fetal echocardiography is being carried out.

Tilt room

4.24 The room should be able to accommodate a patient (ambulant) and relative or chaperone, two cardiac physiologists (or one cardiac physiologist and a medical practitioner), and occasionally a cardiologist.

4.25 It will need to contain trolley-mounted ECG equipment and beat-to-beat blood pressure monitoring and recording equipment (specialist tilt monitor), a free-standing, fully-adjustable tilting couch offering all-round access to the patient, and computer workstation for the cardiac physiologists.

Rhythm analysis room

4.26 This room should be equipped with relevant equipment for retrospective analysis of 24-hour ECG and BP data, and air-conditioned computer workspaces. There should be links via modem and fax machines.

Echocardiography reporting room

4.27 A room for the retrospective reading and reporting of echocardiography data should be provided. It may be used for reviewing other cardiac data and for teaching purposes. The room should include air-conditioned computer workspaces. Approximately one workstation will be required for every 2000 studies (per year).
Implantable devices clinic room

4.28 A room is required for analysing and programming implantable devices that have already been inserted.

4.29 It should be able to accommodate the patient on a fully-adjustable couch offering all-round access, and up to two cardiac physiologists, computer workstations and other equipment.

Storage space for pacemaker programmers

4.30 Facilities will be required for the storage and charging of pacemaker programmers.

Special features

4.31 All patient areas require access to a resuscitation trolley (with defibrillator), a mobile suction unit and a cylinder of oxygen on a trolley. Testing rooms should allow space for the use of emergency resuscitation equipment by a crash team when required.

4.32 Medical oxygen outlets should be located in rooms where stress testing and TOEs are undertaken. The latter also requires the provision of medical vacuum.

4.33 Consideration should be given to locating medical oxygen and medical vacuum outlets in all testing rooms to increase flexibility in use.

4.34 Independent climate control is required in all clinical rooms.

4.35 Hand-washing and storage facilities should be provided in each clinical room.

4.36 Wall and floor finishes in all patient areas should be hygienic and easily cleanable.

4.37 Drugs used for the purpose of stress testing and conducting TOEs may be stored within lockable cupboards in the relevant testing rooms or in a central location in the unit.

4.38 Staff crash call should be provided in the testing rooms.

4.39 Requirements for office accommodation and meeting rooms should be determined locally.
5 Catheter laboratories and associated facilities

Introduction

5.1 This unit should be contiguous with the day case unit with which it may share many facilities, for example reception, patient changing, waiting and recovery facilities (see Chapter 7 for details). The following list of requirements is based on this assumption.

5.2 The unit should be close to the cardiac wards (including CCAs) and cardiac operating theatres. Access routes for emergency patients (via A&E or direct ambulance access) should be considered.

5.3 These laboratories will be used for a range of invasive investigations and treatments including:

- cardioversion;
- coronary angiography;
- electrophysiology studies (EPS);
- percutaneous coronary interventions (PCIs);
- radiofrequency ablations (RFAs);
- closure of atrial septal defects (ASDs) and ventricular septal defects (VSDs);
- mitral valvuloplasty;
- insertion of implantable devices (including complex devices).

5.4 Each laboratory should be large enough to accommodate at least six team members plus the patient, and the equipment listed below. It should be at least 7.5 m x 5.5 m.

5.5 Critical areas and dimensions may vary according to local operational and equipment options. It is therefore important to obtain information on client preferences before designing the room in detail.

5.6 Medical services should be provided from ceiling- or wall-mounted outlets and should comprise medical oxygen, medical compressed air and medical vacuum, together with nitrous oxide and active anaesthetic gas scavenging. Alternatively, a pendant solution to medical gases provision may be preferred.

5.7 A multi-angular digital angiographic X-ray system (single or biplane) will be required. Most systems are floor-mounted, although ceiling-mounted options are available. A biplane laboratory is essential for treating congenital cardiac disorders.

Components

Catheter laboratories

5.8 Where ceiling-mounted systems are to be installed, some additional reinforcement of supporting structures may be required.

5.9 Floor-mounted components are normally fixed to the floor by secure heavy-duty fixing devices, capable of retaining a moving mass weighing up to three metric tons with high residual torque.

5.10 A fully-adjustable patient couch will be required. This 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 couch should allow for...
5.12 Tilting couches are available that allow tilting along both axes. The use of such couches may put an additional strain on floor structures, and expert advice should be sought.

5.13 Two to four ceiling-mounted monitors will be required for undertaking angiography and PCI work. These display real-time, digitally recorded angiographic images and basic physiological data. There is a move to flat-panel displays, which will have the effect of reducing suspension and other engineering requirements.

5.14 The monitors should be positioned so they can be easily and comfortably viewed by the operator and do not impede patient access onto the couch. They 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. The physiologist will require good access to the fluoroscopy reference monitor.

5.15 Power injection facilities for contrast media will be required. These are usually trolley-mounted, although there are ceiling-suspended and table-mounted options available.

5.16 A worktop is required for drugs preparation with wall-mounted cupboards above and below (open shelves should not be used for hygiene reasons). A warming cabinet (wall- or bench-mounted) for preparation of contrast media, a wall-mounted controlled drugs cupboard and catheter rack (wall-mounted or free-standing) are also required.

5.17 A leaded apron rack is required, located at the entrance to the room, outside the control area (see paragraphs 5.20–5.22 for details of control area). Wall-mounted racks may require reinforcements to wall structures due to the weight of the leaded aprons. Alternatively, floor-mounted racks may be installed.

5.18 Two computer workstations are required: one for use by a cardiac physiologist/technician
and the other for use by a nurse. Some cardiac physiologists prefer to be stationed in the control area rather than the catheter laboratory. This will have an impact on space requirements.

5.19 Catheter laboratories used for EPS and RFA need to be larger than the standard laboratory outlined above. They need to accommodate two additional team members, four to six monitors (including monitors displaying advanced physiological data) and additional equipment at the cardiac physiologist’s workstation. For EPS work, the cardiac physiologist’s workstation must be situated in the catheter laboratory.

Additional clinical space

5.23 Requirements for additional clinical space adjacent to the laboratory will vary. For example, separate anaesthetic rooms and recovery bays will be required if children are being treated. Alternatively, recovery can take place in the day case unit.

5.24 An area/bay should be provided for non-day case patients transferred from cardiac wards and/or other hospitals on trolleys or beds awaiting treatment. This area should offer good patient privacy. Medical services should be provided from ceiling- or wall-mounted outlets and should comprise medical oxygen, medical compressed air and medical vacuum. (Day case patients will wait in the day case unit.)

Scrub and gowning rooms

5.25 Each catheter laboratory requires direct access from a scrub and gowning room. It should be possible to access the scrub and gowning room without entering the laboratory. See paragraphs 4.56–4.62 of Health Building Note 26 Volume 1 – ‘Facilities for surgical procedures’ for details.

Preparation rooms

5.26 Each catheter laboratory requires direct access from a preparation room. It should be possible to access the preparation room without entering the laboratory.

5.27 The preparation room should provide storage and suitable work surfaces for the laying-up of instrument trolleys. It should be large enough to open packs and maintain a sterile field. See paragraphs 4.63–4.67 and 7.42–7.61 of Health Building Note 26 Volume 1 for further details.

Bulk store

5.28 Storage space for clean and sterile items and equipment is required. See paragraphs 4.133–4.136 of Health Building Note 26 Volume 1 for further details.

Dirty utility rooms

5.29 Each catheter laboratory requires direct access to a dirty utility room. A disposal unit consisting of sink and hopper with concealed cistern, and hand-washing facilities, should be provided. See paragraphs 4.124–4.125 of Health Building Note 26 Volume 1 for further details.
5.30 After use, re-usable instruments (used when implanting devices) should be stored on a distribution trolley in the dirty utility. When the trolley is full it should be taken to the disposal hold prior to dispatch to the central sterile services department (CSSD).

**Accommodation for X-ray imaging generator and computers**

5.31 Accommodation is required for a dedicated X-ray imaging generator and the computers that run the imaging system. They may be installed within a main catheter laboratory or in an adjacent dedicated room.

5.32 The presence of high-tension electricity, and the need for radiation protection for persons working here, should be noted. The practice of providing access to this room from outside the laboratory is positively discouraged on safety and maintenance-efficiency grounds.

**Disposal hold**

5.33 A locked room should be provided to hold bagged refuse, clinical waste, soiled linen and recyclable materials awaiting collection. The room should be accessible from the hospital street.

**Image workstation/review room**

5.34 An image workstation and review room is required. The review room should accommodate approximately eight staff.

**Staff accommodation**

**Housekeeper’s room**

5.35 A lockable storeroom is required for the storage of cleaning supplies and domestic equipment. See paragraph 4.170 of Health Building Note 26 Volume 1 for further details.

**Staff rest room**

5.36 A rest room is required where staff can relax and prepare and consume beverages and light snacks. The room should have windows with a pleasant outlook, and be comfortably furnished with a dining table and chairs. It should include a sink (providing drinking water), a refrigerator, and storage for crockery, cutlery and a limited quantity of dried goods.

**Staff changing**

5.37 Staff changing facilities with showers/WCs are required within close proximity to the catheter laboratories. Access from the changing area to the laboratories should be via a restricted-access corridor. See paragraphs 5.14–5.20 of Health Building Note 26 Volume 1 for further details.

**Office accommodation and meeting rooms**

5.38 Requirements for office accommodation and meeting rooms should be determined locally.

**Special features**

**Radiation**

5.39 The design of the laboratories and associated facilities must comply with the Ionising Radiations Regulations 1999 and Health and Safety at Work etc Act 1974. The catheter laboratory will be a “controlled area” as defined in those regulations, and all defining structures, including floors and ceilings, must be radiation-protected. The choice of construction materials for floors, ceilings and walls must be agreed with the Radiation Protection Advisor (RPA), who must also be consulted on overall radiation protection requirements, including aspects of design and room layout.

5.40 Control areas and other rooms opening onto the laboratories may be categorised as “supervised areas”. Such areas must also be protected, although to a lower level. Again, the choice of construction materials for floors, ceilings and walls must be agreed with the RPA.

5.41 Public access areas must be shielded to allow only very low radiation exposure. The limits of permitted exposure are controlled by legislation as interpreted and determined locally by the RPA.

5.42 Doors into the catheter laboratories must be radiation-shielded and open in such a way as to protect those entering. This aspect of design will be an important part of the consultation with the RPA. There must be “controlled area” and “X-ray on” warning lights adjacent to the door, connected to the X-ray set power supply and generator.

**Other special features**

5.43 All furniture, fittings and fixtures should be easily cleanable.
6 Minor cardiac procedures room and associated facilities

Introduction

6.1 This unit should be contiguous with the day case unit with which it may share many facilities, for example reception, patient changing, waiting and recovery facilities (see Chapter 7 for details). It should also be close to the catheter laboratories with which it may share staff accommodation. The following list of requirements is based on this assumption.

6.2 The unit should be close to the cardiac wards (including CCAs) and cardiac operating theatres.

6.3 The purpose of the minor cardiac procedures room is to provide:

- a safe environment in which to carry out relatively minor procedures where the risk of infection is low and the immediate recovery period is short;
- an appropriate alternative location to the catheter laboratory for the safe insertion and/or replacement of implantable devices, except complex devices.

Components

Minor cardiac procedures room

6.4 The minor cardiac procedures room should be able to accommodate a moveable, fully-adjustable and long-axis tilting couch (offering all-round access to the patient), a mobile single C-arm X-ray imaging system, controls and trolley-mounted monitor, ceiling-mounted minor operating light, and a small surgical procedures trolley.

6.5 An area of 28 m² for each minor procedures room is recommended.

6.6 Medical services should be provided from ceiling- or wall-mounted outlets and should comprise medical oxygen, medical compressed air and medical vacuum, together with nitrous oxide and active anaesthetic gas scavenging. Alternatively, a pendant solution to medical gases provision may be preferred.

6.7 Wall-mounted fixtures and fittings, where provided, should have ‘easy clean’, non-dust-collecting surfaces.

6.8 Lead aprons and their storage hangers should be located adjacent to the entrance to the minor procedures room.

Anaesthetic room and recovery bay

6.9 A separate anaesthetic room and recovery bay will be required if children are being treated. Alternatively, recovery can take place in the day case unit.

Scrub and gowning room

6.10 The minor cardiac procedures room requires direct access to a scrub and gowning room. Alternatively, scrub and gowning facilities may be located in the corner of the minor cardiac procedures room. See paragraphs 4.56–4.62 of Health Building Note 26 Volume 1 for details.

Preparation room

6.11 There should be a preparation room, located in an adjacent communicating space. See paragraph 5.27 and paragraphs 4.63–4.67 and 7.42–7.61 of Health Building Note 26 Volume 1 for further details.

Bulk store

6.12 Storage space for clean and sterile items and equipment is required. See paragraphs 4.133–4.136 of Health Building Note 26 Volume 1 for further details.

Dirty utility room

6.13 The minor cardiac procedures room requires direct access to a dirty utility room. A disposal unit consisting of sink and hopper with concealed cistern should be provided. Hand-washing facilities
should be provided. See paragraphs 4.124–4.125 of Health Building Note 26 Volume 1 for further details.

6.14 After use, re-usable instruments (used when implanting devices) should be stored on a distribution trolley in the dirty utility. When the trolley is full it should be taken to the disposal hold prior to dispatch to the central sterile services department (CSSD).

Disposal hold

6.15 A locked room should be provided to hold bagged refuse, clinical waste, soiled linen and recyclable materials awaiting collection. The room should be accessible from the hospital street.

Special requirements

6.16 Consultation with the RPA will be necessary to determine whether and to what extent radiation protection is required in the minor procedures room.

6.17 Light leaded screening of doors may be necessary, and this may have structural implications.

6.18 A wall-mounted controlled drugs cupboard may be located in the minor cardiac procedures room or anaesthetic room (where provided).
Introduction

7.1 This chapter describes a dedicated day case unit for cardiac patients. This unit should be contiguous with the catheter laboratories and minor cardiac procedures rooms. It should be close to restaurant and snack facilities.

7.2 The day case unit provides facilities for day patients undergoing invasive procedures. Patients will register, change and wait here prior to treatment, and will recover here following treatment, in either the bed area or the waiting area. There should be separate units for adults, children and adolescents.

Components

Reception and waiting area

7.3 There should be a reception area incorporating a reception desk with a number of computer workstations, waiting area, WC facilities including accessible WCs, and facilities for refreshments. Ideally, there should be separate waiting areas for changed and unchanged patients. Children’s units should include a play area.

Patient changing

7.4 Full-length lockers should be provided for the secure storage of outdoor clothing. Patient changing facilities should comprise curtained cubicles or separate changing rooms for patients to change in privacy. Separate storage for clean and used gowns should be provided. Shower facilities should be provided.

Bed area

7.5 Accommodation should comprise four-bed bays. Bed-head systems should be as specified in paragraphs 13.49–13.51. Hand-washing facilities should be provided.

7.6 Care must be taken to ensure sufficient space to allow proper control of infection procedures to be observed. Personal washing/shower/WC facilities should be provided with ease of access from the bed areas and for the disabled.

Staff base

7.7 The staff base should be centrally located, overlooking the bed area, with desk space for three persons and surveillance of patient/staff call lamps and access to the controlled drugs cupboard. The latter should be positioned with due regard to the need for security.

Interview rooms

7.8 A quiet, private space should be provided for counselling/discussions.

Clean utility room

7.9 Storage space for clean and sterile supplies should be provided. The controlled drugs cupboard may be located here. Hand-washing facilities should be provided.

Dirty utility room

7.10 This should include a slop-hopper, facilities for bedpan decontamination and urine testing. Hand-washing facilities should be provided.

Linen store

7.11 Facilities are required for storing linen, including an exchange linen cart or suitable alternative.

Disposal hold

7.12 A locked room should be provided to hold bagged refuse, clinical waste, soiled linen and recyclable materials awaiting collection. The room should be accessible from the hospital street.

Special features

7.13 These are as follows:

• bed areas should be designed to allow interchangeable use of beds/trolleys;
• bed areas should be large enough to accommodate relatives and escorts who may wish to spend a substantial part of the recovery period with the patient, and to prevent cross-infection;

• resuscitation trolley (with defibrillator) should be kept close to the staff base;

• hand-washing facilities should be provided.
8 Facilities for cardiac surgery

Introduction
8.1 This chapter describes a designated cardiac operating theatre suite, insofar as it varies from standard surgical facilities.

Functions
8.2 The theatre should provide a safe operating environment for in-patients to undergo simple procedures, closed and open-heart cardiac and thoracic surgery, and heart and heart/lung transplants.
8.3 It should include facilities for clinical teaching and research.

Components
8.4 Facilities within a cardiac operating theatre suite will be similar to those described in Health Building Note 26 Volume 1. However, cardiac operating theatres need to be larger than standard operating theatres to accommodate additional staff and equipment (see paragraph 8.13), and there is an additional requirement for a perfusion preparation room (see below for details).
8.5 The recovery area for cardiac theatres does not need to be as large as the recovery area for standard operating theatres (see below for details).

Perfusion preparation room(s)
8.6 A perfusion preparation room adjoining each theatre is required, for cleaning and setting up of perfusion (heart/lung) machines. The room may be provided separately for each theatre, or shared between pairs of theatres.
8.7 There should be at least three perfusion machines for each pair of theatres (that is, one per theatre, plus one spare).
8.8 The room should contain a computer workstation for accessing patient records, and work surfaces of

Cardiac operating theatre, Heart & Lung Centre, Wolverhampton (© Medical Illustration, Royal Wolverhampton Healthcare Trust)
sufficient height to store trolleys underneath and be fitted with cupboards and shelving. Perfusion machines, balloon pumps and cell savers will be stored in this space when not in use.

**Perfusion storage room**

8.9 A storage room for disposable equipment is required, adjacent to the perfusion preparation room. It should be large enough to enable storage of large quantities of disposable packs, and volumes of fluids. It will require heavy-duty shelving. Equipment servicing and routine maintenance will be carried out in this room.

**Recovery area**

8.10 A four-bed recovery room is recommended for a facility comprising four cardiac operating theatres. This is less than the eight beds recommended in Health Building Note 26 based on the provision of four operating theatres since a large proportion of cardiac surgical patients will go directly to CCAs rather than remaining in recovery.

8.11 Planning teams may wish to consider fast-track post-anaesthetic care for cardiac patients whereby selected patients remain in recovery with level 3 support rather than being transported immediately post-operatively to a CCA. Additional spaces in the recovery room will be required if this arrangement is implemented.

**Equipment store**

8.12 A storage area for infusion pumps, echocardiography machines and mobile X-ray equipment is required. Facilities for recharging should be provided. A shelved unit with spaced access to electrical plugs should also be provided.

**Operating theatres**

**Dimensions**

8.13 All theatres in which cardiac work is carried out will be of a minimum area of 63 m², broadly rectangular and with a minimum dimension in any single direction of 7 m. They will be grouped in pairs, each capable of supporting the broad range of cardiac and cardiothoracic work undertaken.

8.14 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.

**Occupancy**

8.15 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.

8.16 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.

**Services and equipment**

8.17 Each theatre should be able to accommodate bulky equipment such as a perfusion machine, balloon pump, cell savers, echocardiography machine and mobile C-arm X-ray unit and monitors.

8.18 Modern techniques may require minimally invasive "stacks" and numerous sterile trolleys.

8.19 Robotics, when used, need very careful siting within the operating theatre.

8.20 Each theatre should accommodate two service pendants. These should be positioned so that during bypass operations surgical teams have exclusive access to and control over their own set.

8.21 A small bay equipped with a shelf for examining specimens should be provided.

8.22 Theatres should be provided with medical oxygen, nitrous oxide, medical and surgical compressed air, medical vacuum and anaesthetic gas scavenging.

8.23 A least one theatre should have colour closed-circuit television (CCTV) incorporated into the theatre lamp system and linked to a seminar room, for teaching purposes.

8.24 Two exit bays, one for each pair of operating theatres, should be provided. Each bay should be approximately 23 m² to accommodate the parking of two beds or trolleys awaiting the return of patients from theatre. They may also contain local storage.
Functional relationships

8.25 The operating theatre suite should:

- be close to CCAs (fundamental relationship);
- be close to the catheter laboratories;
- provide close, simple access to and from the CCU and cardiac wards, ideally located on the same floor, if not with immediately accessible lift connection;
- be close to the anaesthetic department and offices of consultant surgeons;
- have good connections with sterile services.

8.26 Changing rooms, staff catering facilities and rest rooms should be sited within or adjacent to the theatre. See paragraphs 5.38–5.39 for further details.
9 Staff and support accommodation

Introduction
9.1 This chapter describes staff and support accommodation associated with cardiac care facilities, other than accommodation directly associated with patient care areas described in Chapters 3 to 8.

Staff accommodation
9.2 Staff accommodation should be designed to allow consultant medical staff and their secretarial support to communicate effectively both within and across clinical specialties, enabling them to deliver their clinical commitments effectively.

9.3 This accommodation is a setting for clinical teaching and research not involving the physical presence of patients.

9.4 It comprises:
- offices for consultants, secretaries, nurses, technicians and managers;
- adequate seminar facilities, with audio-visual services, library etc;
- other facilities to accommodate teaching and research activities, to be discussed with the client.

Functional relationships
9.5 While it is important that members of specialist consultant teams have ready access to their specific ward and operative areas, it is equally important that their offices should generally have close proximity to each other, to offer better cover, to streamline referrals between specialties, and to allow close proximity to research facilities.

Support accommodation
9.6 An IT room containing the network servers and communications equipment for the cardiac service will be required.

9.7 The room should be large enough, not only to contain the equipment intended to be installed initially, but also to allow for expansion of facilities at a later date. There may be a need at some time to install replacement equipment before existing equipment is removed.

9.8 The room should ideally be separate from other equipment rooms in the unit and should be separately securable. The equipment in the room should not be visible from outside the room.

9.9 Arrangements should be made to ensure that the environment in the room is suitable for the equipment that may be kept in the room. This could include controlling the temperature, humidity and levels of dust etc in the air.

9.10 There must be adequate space for staff to be able to access the equipment for maintenance purposes. It should be ensured that this maintenance can be done without inconveniencing the normal operation of the unit.

9.11 A secure storage area should be provided for storing back-up media.


10 General engineering principles

Introduction

10.1 This chapter provides engineering guidance for cardiac care facilities. Specific requirements should be formulated in discussion with both end-users and manufacturers of specialist equipment.

10.2 It is assumed that, other than in catheter laboratories, diagnostic systems involving a need for specialist radiological protection advice will not form part of the cardiac care facility and will be provided by a specialist imaging department. Where this is not the case, reference should be made to Health Building Note 6 Volume 1 for further information regarding special engineering requirements.

Economy and value engineering

10.3 Engineering services account for a significant proportion of the capital cost and a continuing charge on revenue budgets. The project design engineer should ensure economy in provision, whilst achieving functional requirements and maintaining clinical standards.

10.4 Lifetime costs should be identified as part of the cost-benefit analysis.

Energy conservation and sustainability

10.5 The commitment of the NHS to sustainable development is encapsulated in the document ‘Sustainable development in the NHS’. Whilst this document considers a wide range of sustainability issues, one area identified as having a major impact on the environment is the use of energy. The minimising of environmental impact by ensuring that energy is only used necessarily and efficiently is considered in this section with regard to:

- building regulations;
- heat recovery.

10.6 Energy-using systems including heating, ventilation, cooling and lighting should be controlled to reduce energy input to the facility, or sections of it, when it is not in use (for example at night or weekends).

10.7 Energy recovery systems should be considered for air-conditioning and ventilation systems.

10.8 Facilities should be designed to meet the requirements of Approved Document Part L2, Department for Transport, Local Government and the Regions.

Natural lighting

10.9 Natural lighting should be used where possible. Passive solar design (PSD) should ensure that clinical and public areas are located where they can benefit from natural daylight. Areas that do not benefit from natural lighting (for example stores and toilets) should be located towards the core of the facility.

10.10 Solar protection should be provided to minimise solar gain and control glare. This may include the use of brise soleil, solar reduction glazing, and internal or mid-pane blinds. Areas where glare may be a problem (for example rooms where computers are routinely used) should be located away from direct daylight.

10.11 Glazing solutions should achieve an average daylight factor of 2%. This should result in the optimum control of glare and solar gain consistent with adequate daylight. Where solar performance glass is used, this should be a neutral colour to ensure good colour rendering.

Natural ventilation

10.12 Natural ventilation should be used where possible.

10.13 The design should incorporate measures for minimising solar heat gain (see paragraph 10.10).
This will reduce the need for mechanical ventilation.

**Mechanical ventilation**

10.14 The shape of the building and/or spatial relationships may result in some deep-planned internal areas. Ventilation costs can be minimised by ensuring that internal areas are reserved for:

- rooms that require mechanical ventilation irrespective of whether their location is internal or peripheral (for example sanitary facilities);
- spaces that only have transient occupation and therefore require little or no mechanical ventilation (for example circulation and some storage areas).

**Heat recovery**

10.15 Given that air supply systems will use 100% fresh air, the practicalities of heat recovery should be investigated. When doing so, consideration should be given to the following potential hazards:

- leakage/recirculation between intake and exhaust air streams;
- biohazards to maintenance staff.

**Space required for plant and distribution systems**

10.16 Plant areas should provide convenient and safe access, arranged to prevent unauthorised entry. Plant and equipment should be spaced to permit access for routine inspection and maintenance. Removal and replacement of plant and components should be possible without disruption to other services.

10.17 To be most economical, plant should be located as close as possible to areas served, but with due regard to factors such as noise, vibration, flooding and fire. The risks associated with these factors can be minimised by the introduction of measures such as active fire suppression systems and additional acoustic treatment. A risk analysis should be undertaken to explore the most appropriate solution.

10.18 Space should be allowed within walls and above ceilings to facilitate the concealment of electrical and mechanical services where possible. Securable demountable panels should be provided to allow access to control and isolation valves as well as any equipment that is necessarily concealed within the spaces. Each panel should be clearly, but discreetly, marked to identify the controls or equipment to be found behind the panel.

10.19 In general, with the exception of drainage, engineering services should not be brought from the above-ceiling space of a floor below. Service distribution to a particular area should be contained in service spaces on that floor.

10.20 Wherever possible, access to plant and services should be from within plantrooms or maintenance areas. Where this is not possible, every endeavour should be made to effect access from general circulation areas and not from operational spaces.

10.21 Recommended spatial requirements for mechanical, electrical and public health engineering services are contained in Health Technical Memorandum 00 – ‘Policies and principles’.

10.22 Further information is provided in Building Services Research & Information Association (BSRIA) technical notes (TN) 9/92 and 10/92, and BG 14/03.

**Maintenance of plant and services distribution**

10.23 All plant (except heat rejection and certain ventilation extract plant) should be located within plantrooms. Main services distribution (cabling and pipework) should be routed above corridors and other circulation spaces. This will allow inspection, maintenance, modifications, additions and renewals to be undertaken with out disruption to clinical areas.

**Flexibility of design**

10.24 Engineering installations should provide an organised and systematic arrangement that can be modified to facilitate changes in service requirements. This should be achieved by distributed systems with vertical or horizontal services ducts and bench spines. These should be readily accessible so they can be remodelled and maintained with minimal disruption to the facility.

10.25 Designers should provide solutions that enable alternative items of equipment to be used in the future (for example in catheter laboratories)
Design for safety

10.26 Health and safety legislation imposes a statutory duty on all persons who design, manufacture, import, supply, install or erect “articles for use at work” through a range of coordinated health and safety regulations enacted under the Health and Safety at Work Act etc 1974.

10.27 Key safety regulations relating to healthcare premises and equipment are:

- the Construction (Design and Management) Regulations 1994;
- the Control of Substances Hazardous to Health (COSHH) Regulations 2002;
- the Gas Safety (Installation and Use) Regulations 1998;
- the Health and Safety (Safety Signs and Signals) Regulations 1996;
- the Management of Health and Safety at Work Regulations 1999;
- the Noise at Work Regulations 1989;
- the Pressure Equipment Regulations 1999;
- the Pressure Systems Safety Regulations 2000;
- the Provision and Use of Work Equipment Regulations 1998;

10.28 “Permit to work” and “permit to use” procedures should be used, particularly in respect of electrical systems (see Health Technical Memorandum 06-02 – ‘Electrical safety code for low voltage systems’ and Health Technical Memorandum 06-03 – ‘Electrical safety code for high voltage systems’) and medical gas systems (see Health Technical Memorandum 02-01 – ‘Medical gas pipeline systems’).

10.29 Local exhaust ventilation will be required where exposure by inhalation of substances hazardous to health cannot be controlled by other means. Health & Safety Executive (HSE) publication EH 40 – ‘Occupational exposure limits’, updated annually, sets limits that form part of the COSHH Regulations 2002.

10.30 The vulnerability of patients in healthcare premises, where many engineering systems impact on patient safety, introduces additional risks and calls for an increased awareness of the importance of engineering system integrity. Engineering systems should be designed to be especially robust to ensure that a failure in the quality or continuity of an essential engineering service cannot compromise patient safety.

10.31 Devices for the control and isolation of primary engineering services should be located in locations where they can be protected against unauthorised interference. This will include all plantrooms, engineering service spaces and circulation areas. Controls should not be located in clinical areas.

Infection control

10.32 Engineering design has an important role in infection control, particularly the design of water and ventilation services. See Health Technical Memorandum 04-01 – ‘The control of Legionella, hygiene, “safe” hot water, cold water and drinking water systems’ and Health Technical Memorandum 03 – ‘Ventilation systems’ for further details.

Acoustics

10.33 Excessive noise can adversely affect the working environment, distracting staff and causing distress and discomfort to patients. The limits and means of control are described in Health Technical Memorandum 08-01 – ‘Acoustics’.

10.34 Conversely, prolonged periods of silence or near silence can be equally distressing to a patient undergoing treatment and, where appropriate, consideration should be given to the provision of a source of low-level sound, for example background music.

10.35 Auditory privacy will be required in a number of areas (for example consultation and examination rooms). Acceptable noise levels and requirements for auditory privacy in individual areas are shown on the Activity Data A-sheets.

Fire safety and precautions

10.36 The principles of fire safety apply equally to new projects, alterations and upgrading of existing buildings.
10.37 Consideration should be given to the fire safety strategy during the design stage. The architect and engineer should verify the proposals with the relevant fire authority. The project team and all other planning staff should be fully acquainted with the fire safety strategy. This will include operational aspects such as staff responsibilities, equipment provision, building and engineering layouts.

10.38 Fire safety policy is set out in the 'Firecode' series of documents (to become Health Technical Memorandum 05 ‘Fire safety’).

10.39 Designers must comply with Approved Document B, Office of the Deputy Prime Minister.

Commissioning of engineering services

10.40 It will be necessary to commission engineering services to catheter laboratories, particularly those related to ventilation, prior to the installation and commissioning of imaging equipment. Accordingly, appropriate integration of the building services commissioning schedule with the equipment supplier's installation and commissioning schedule should be undertaken at an early stage.
### 11 Mechanical engineering services

#### Introduction

11.1 Mechanical services may include the following:
- heating system;
- hot and cold water systems;
- ventilation systems;
- refrigeration plant;
- environmental control and building management systems;
- medical gases;
- steam and condensate systems;
- sterilizing and washer disinfector equipment.

11.2 For the purposes of this document the installation is deemed to include each system from the point of entry to the facility to the final connection to service outlets or specific equipment. Reference should be made to Activity Data Sheets for individual space technical design data.

#### Heating system

11.3 A building management system (BMS) should control the heating system in zones to ensure that it is automatically set back or turned off when the facility, or zones within the facility, is/are not in use. Heating throughout the facility should be controlled to a minimum “set-back” temperature of 10°C during “out of use” hours. The BMS is normally equipped with a manual override to permit restoration of the plant to full operational status at short notice.

11.4 In areas other than theatres, catheter laboratories, treatment rooms, sterile preparation rooms and other plenum ventilated/air-conditioned accommodation, general space heating requirements can be met by either wall-mounted low-pressure hot water radiators or ceiling-located low-pressure hot water emitters.

11.5 The surface temperature of wall-mounted radiators should not exceed 43°C. Ceiling-mounted radiant panels can exceed this surface temperature and will allow floor space savings. Exposed heating pipework at temperatures above 43°C and accessible to touch, should be encased or insulated.

11.6 Radiators should be located under windows or against exposed walls. There should be space between the top of the radiator and the windowsill to prevent curtains reducing the output. There should be adequate space underneath, at least several inches, to allow cleaning machinery to be used. Where a radiator is located on an external wall, back insulation should be provided to reduce the rate of heat transmission through the building fabric.

11.7 All radiators should be fitted with thermostatic control valves. These should be of robust construction and selected to match the temperature and pressure characteristics of the system. The thermostatic head should incorporate a tamper-proof facility for pre-setting the maximum room temperature. It should be controlled via a sensor located integrally or remotely. To provide frost protection, the valve should not remain closed below a fixed temperature.

11.8 Radiators should be used to offset only building fabric heat loss in mechanically ventilated rooms. All rooms should have local heating controls: the facility should be controlled throughout by the BMS (see paragraph 11.3 for details).

11.9 Ceiling heating panels may operate at higher surface temperatures than 43°C as long as the surface is not readily accessible. Heating panels should run around the perimeter of the building. Panels should not be located over beds, patient trolley positions or in other locations where they might radiate directly down on a patient or member of staff for a prolonged period.
11.10 Ceiling panels should be selected to aesthetically match the adjacent ceiling and should be sealed to the adjacent ceiling by means of a gasket or similar device.

11.11 Heating loops of ceiling panels should be controlled by automatic valves located above the ceiling and actuated from room thermostats. In large spaces several loops should be provided, each controlled from its own thermostat, to serve separate zones within the space.

**Hot and cold water systems**

11.12 Hot and cold water storage and distribution systems should be designed in accordance with the requirements of Health Technical Memorandum 04-01.

11.13 Whilst cold water storage at high level will be the norm, care should be taken to ensure that all equipment proposed for the facility is capable of operating from the available static head. Where the static head is insufficient, a pressurisation set incorporating dual pumps should be installed.

11.14 All cold water pipework, valves and fittings should be insulated and vapour-sealed to protect against frost, condensation and heat gain.

11.15 The domestic hot water supply should be taken from the calorifiers installation at a minimum outflow temperature of 60°C ± 2.5°C and distributed to all outlets in a manner that ensures a return temperature to the calorifiers of at least 50°C. Exposed hot water pipework, accessible to touch, should be encased or insulated.

11.16 Where possible, automatic water-conserving taps actuated by proximity detectors should be used. When specifying taps for surgeons’ troughs, consideration should be given to the use of automatic mixer units providing water at a predetermined temperature for a predetermined length of time.

**Ventilation (general)**

11.17 Air movement induced by mechanical ventilation should be from clean to dirty areas, where these can be defined. The design should allow for adequate flow of air into any space having only mechanical extract ventilation, via transfer grilles in doors or walls. However, such arrangements should avoid the introduction of untempered air and should not prejudice the requirements of Firecode or privacy.

11.18 Mechanical ventilation should ensure that both supply and extract systems are in balance, and take account of infiltration, as appropriate.

11.19 Fresh air should be introduced via a low-velocity system and should be tempered and filtered before being distributed via high-level outlets. Diffusers and grilles should be located to achieve uniform air distribution within the space, without causing discomfort to patients or staff.

11.20 A separate extract system will be required for “dirty” areas, for example toilet facilities. It should operate continuously throughout working hours. A dual motor fan unit with an automatic changeover facility should be provided.

11.21 External discharge arrangements for extract systems should be protected against back pressure from adverse wind effects and should be located to avoid reintroduction of exhausted air into this or adjacent buildings through air intakes and windows.

**Ventilation of cardiac operating theatres**

11.22 Where a cardiac operating theatre(s) is included as part of the cardiac care facility, air-conditioning systems in accordance with Health Building Note 26 Volume 1 and Health Technical Memorandum 03 should be provided.

11.23 The floor area of a cardiac operating theatre is substantially larger than a general operating theatre (63 m² compared with 55 m²), with consequentially greater demands on the air-conditioning plant.

11.24 Cardiac surgery generally requires the deployment of a greater than usual inventory of medical equipment in the theatre, and care should be taken by the design team to establish the heat gain from this equipment and to make adequate provision in the design of the air-conditioning plant for dealing with it.

11.25 Facilities for patient cooling during low-temperature surgery should be provided.

**Ventilation of catheter laboratories and minor cardiac procedures rooms**

11.26 In establishing the nature of the ventilation regime to be provided in these facilities it is imperative to ascertain at the outset the spectrum of procedures
that will be undertaken within the particular facility.

11.27 Many simple procedures of short duration, such as the inserting of temporary pacemakers and simple implantable devices, will require ventilation only to the standards of a treatment room, whilst more lengthy procedures including PCIs, RFAs, closure of ASDs and VSDs will require air-conditioning to operating theatre standards.

11.28 In determining the engineering solution applicable to the particular installation, the design team should consult with the clinical team and the control of infection officer, and undertake a risk assessment to ensure that the solution is appropriate.

11.29 Whilst an over-engineered solution cannot be encouraged, care should be taken to ensure that any solution decided upon takes into account any need for future-proofing, since retrospective fitting of full air-conditioning is both expensive and disruptive.

**Ventilation of physiological measurement rooms**

11.30 Rooms specifically identified for the taking of physiological measurements, in particular exercise ECG and echocardiography rooms, should be ventilated and comfort-cooled with local temperature control.

11.31 Consideration should be given to the need for a quiet environment, particularly if local split systems for cooling are to be used (see also paragraph 11.33).

**Ventilation cooling systems**

11.32 Refrigeration loads for ventilation systems should be met either by the hospital’s central water chiller plant, or by packaged, remotely located water chiller plant dedicated to the cardiac facility. Direct expansion systems are not advocated unless the refrigeration load is small, since direct expansion plant can only be controlled in steps, unlike chilled water, which can be continuously modulated.

11.33 Heat rejection plant should consist of air-cooled condensers. Wet cooling towers must not be used.

**Building management system (BMS)**

11.34 Ventilation and air-conditioning systems should be controlled by a BMS, which will automatically set back or turn off plant when the area served is not in use. Ventilation systems should be controlled to ensure a minimum “set-back” temperature of 10°C during “out of use” hours to facilitate rapid warm-up if necessary, and the BMS should be equipped with a manual override to permit restoration of the plant to full operational status at short notice.

11.35 Supply and extract ventilation systems should include local indicator lamps to confirm the operational status of each system.

11.36 The indicators for a system serving a particular space should be both immediately adjacent to the space and at a central staff base.

11.37 Where manual controls are available for staff use, they should be provided with labels that clearly define their function.

**Piped medical gases and vacuum**

11.38 Medical gases should be provided to the various clinical areas in accordance with Health Technical Memorandum 02-01.

**Medical oxygen**

11.39 The main hospital’s vacuum insulated evaporator (VIE) should have capacity to satisfy the requirements of the facility. Should this not be the case, consideration should be given to increasing the capacity of the VIE. The provision of a local oxygen manifold should be considered a solution of last resort.

**Nitrous oxide**

11.40 Facilities for cardiac surgery should be provided with nitrous oxide from a manifold in accordance with Health Technical Memorandum 02-01.

**Medical vacuum**

11.41 A separate medical vacuum plant consisting of at least two identical pumps, a vacuum reservoir with by-pass facilities, two duplex bacteria filters with drainage traps, appropriate non-return valves, isolating valves, gauges and switches, an operating and indicating system, an exhaust system and a test point should be provided. The plant should have good all-round access for maintenance and
should be sited to allow for adequate flows of air to cool the pumps.

11.42 Due consideration should be given to the containment of noise from the plant. A suitable acoustic enclosure may be required to effect compliance with the noise levels deemed acceptable in Health Technical Memorandum 02-01.

Medical (400 kPa) and surgical (700 kPa) compressed air

11.43 A limited requirement for compressed air can be met from cylinders. If a more substantial demand is identified, separate compressed-air plant consisting of air intake filters, at least two identical compressors with after-coolers, pressure-reducing valves, appropriate non-return valves, an air receiver with pressure relief valve, isolating valves, gauges and switches, an operating and indicating system, and a test point should be provided.

11.44 The plant should have good all-round access for maintenance and should be sited to allow for adequate flows of air to:

- provide air to the intakes of the compressors;
- provide cooling of the compressed air by the after-coolers;
- cool the compressors themselves.

11.45 Due consideration should be given to the containment of noise from the plant. A suitable acoustic enclosure may be required to effect compliance with the noise levels deemed acceptable in Health Technical Memorandum 02-01.

Fire protection systems

11.46 Fire protection systems should comply with the requirements of Health Technical Memorandum 81 – ‘Fire precautions in new hospitals’ (to become Health Technical Memorandum 05).

11.47 Generally, sprinkler systems within catheter laboratories are discouraged since their accidental operation can result in significant equipment damage and downtime. Normally a type “C” extinguisher will suffice for a fire-fighting response as long as the fire load is kept low.

11.48 If a local authority insists on a sprinkler system, sprinkler heads should not be located directly above equipment.

11.49 To avoid damage from head leakage, consideration should be given to the provision of a "dry pre-action" system in which the sprinkler heads remain dry until called into operation by the detection system.

11.50 Where a “wet” system is used, semi- or fully-recessed high-temperature heads should be used.

11.51 Dry risers should be provided adjacent to stairwells, with branch hose connections at each landing. First-aid hose reels and sprinkler systems will not generally be provided unless there is a specific requirement to do so by the local fire authority.

11.52 Where there are major IT equipment rooms located within the facility there may be a need for the provision of a gas extinguishing system.

Steam

11.53 The requirement for steam within the facility will be limited to humidification equipment associated with special ventilation plant to operating theatres, together with sterilization and washer-disinfection equipment if installed. If available, steam from the hospital’s main supply should be used, subject to the requirement for clean steam as set out in Health Technical Memorandum 01 – ‘Disinfection and sterilization’.

11.54 In the absence of a central steam supply, local steam generators, preferably powered from a firm gas supply, should be employed.
12 Drainage requirements

Internal drainage

12.1 The internal drainage system should:
- use the minimum of pipework;
- remain water- and air-tight at joints and connectors;
- have sufficient ventilation to retain the integrity of water seals;
- include clear labelling of waste pipes that may contain radioactive waste or effluent.

12.2 The cardiac facility should be provided with a system of soil and waste drainage including anti-siphon and ventilation pipework in accordance with BS EN 12056-1.

12.3 Where plastic pipework materials are used, suitable intumescent collars should be fitted when breaching fire compartments, and acoustic wrapping should be applied when drainage runs above patient areas.

12.4 The gradient of branch drains should be uniform and adequate to convey the maximum discharge to the stack without blockage. Practical considerations, such as available angles of bends, junctions and their assembly, as well as space considerations, will normally limit the gradient to about 1:50 (20 mm/m). For larger pipes, for example 100 mm in diameter, the gradient may be less, but this will require high-quality workmanship if an adequate self-cleaning flow is to be maintained. It is not envisaged that pipes larger than 100 mm diameter will be required within inter-floor or ground-floor systems serving this facility.

12.5 Bedpan washers or macerators should discharge with a short branch to a vertical stack or horizontal drain. The waste pipe should not be installed above or close to heating or hot water mains. If a bedpan washer or macerator discharges to a 100 mm drain, frequently-used large-volume appliances should be situated upstream of its connection to provide additional flushing.

12.6 Provision for inspection, rodding and maintenance should ensure “full bore” access and be located to minimise disruption or possible contamination. Manholes should not be located within this facility.
Introduction

13.1 Electrical services may include the following:
- main intake switchgear and distribution board;
- emergency electrical supplies;
- small power distribution systems;
- lighting systems;
- IT cabling systems;
- telephone systems;
- security systems;
- staff call, public address and entertainment systems;
- lightning protection.

13.2 Electrical installations should comply with BS 7671 and Health Technical Memorandum 06-01 – ‘Electrical services and distribution’.

13.3 Care should be taken to avoid mains-borne interference and electrical radio frequency interference affecting diagnostic and monitoring equipment, computers or other sensitive electronic equipment.

Main intake switchgear and distribution board

13.4 The nature of the incoming supply, whether high voltage (HV) or low voltage (LV), will depend on the capacity of existing site distribution relative to the demand of the proposed facility.

13.5 Access to HV equipment rooms must be secure and entry restricted to HV authorised persons and HV competent persons. Access to LV equipment rooms should be similarly secure, although the restrictions regarding authorised access are less rigorous.

13.6 Wherever possible, equipment should be mounted at a height that gives safe and easy access from a standing position. All switchgear should be lockable in the “off” position.

Emergency electrical supplies

13.7 Emergency electrical provision should comply, as a minimum, with the requirements of Health Technical Memorandum 06-01.

13.8 The emergency generator providing electricity in the event of a main supply failure should be capable of providing full (100%) backup to the exclusion of refrigeration plant serving air-conditioning and comfort-cooling plant. If a new generator dedicated to the cardiac facility is to be installed, this should be the solution of preference.

13.9 If an existing generator is to be used, the extent of emergency coverage will be dependent on the spare capacity available, subject to a minimum provision. If this minimum requirement cannot be met, it will be necessary either to replace the existing generator with a larger set, or to provide an additional generator dedicated to the facility.

13.10 Where possible, generator rooms should be co-located with electrical intake rooms and associated switchgear.

13.11 Equipment and systems that cannot tolerate the delay inherent in bringing a generator supply on line, including imaging systems and computers, should be further protected against outages by the provision of solid-state non-interruptible power supplies.

13.12 During mains power failure, the possibility of limited operation of the angiography imaging system to permit the removal of a catheter under X-ray control should be expressly considered, and discussed with the hospital’s and system manufacturer’s engineers.

13.13 In the event of a main supply or local final circuit failure, escape routes should be illuminated by self-contained, battery-powered luminaires charged continuously from the main supply and
capable of providing illumination for a period of three hours.

**Small power distribution systems**

13.14 Depending upon the available capacity of the emergency generator installation it may be necessary to provide separate essential and non-essential small power distribution systems as detailed in Health Technical Memorandum 06-01.

13.15 Thirteen-amp switched and shuttered socket-outlets in accordance with the requirements of the room data sheets should be provided, connected to ring or spur circuits. It may be preferable for socket-outlets in critical care areas, for example cardiac intensive care, to be unswitched, thus obviating the possibility of essential equipment accidentally being switched off.

13.16 Where there is separation between essential and non-essential small power distribution, socket-outlets served by the essential distribution should be clearly marked with an engraved red capital letter “E”.

13.17 The special requirements of BS 7671 and Guidance Note 7, Institute of Electrical Engineers (IEE) in respect of medical locations and associated areas should be adhered to. The electrical supply connections to all medical electrical equipment should comply with BS EN 60601-1-2.

13.18 The earth connection at the power termination should be suitable for the functional earth requirements specified by the specialist equipment manufacturer and arranged to receive a direct connection from the earth reference terminal, which should be provided or designated in every diagnostic and treatment room. Further guidance on the purpose, characteristics and performance criteria of an earth reference terminal is given in Health Technical Memorandum 06-01.

13.19 Guidance on the power supply requirements for fixed and mobile radiodiagnostic equipment is contained in Health Technical Memorandum 06-01, whilst guidance on engineering accommodation for this equipment may be found in Health Building Note 6 Volume 1.

13.20 Where equipment is permanently installed or where there is a possibility of equipment theft, switched double-pole 13-amp spur outlets should be used in preference to socket-outlets. The spur outlet should incorporate a red neon lamp indicating when the supply to the equipment is live.

13.21 Equipment requiring a three-phase supply should be permanently connected to a separate sub-circuit. The sub-circuits, incorporating a circuit breaker, should be fed from the distribution board and terminate in a local isolator.

13.22 Adequate provision should be made in circulation areas, for example corridors and lobbies, to permit the use of domestic cleaning equipment having flexible cords up to 9 m long.

13.23 Isolation switches should be provided immediately adjacent to all engineering plant and equipment, clearly labelled to identify the equipment that they relate to.

13.24 Heating appliances and automatic equipment should be provided with red neon lamps indicating when they are energised. The neon lamps should be incorporated in the control panel of the equipment, in the control switch, or in the socket-outlet or spur unit from which the equipment derives its supply.

**Lighting systems**

13.25 To achieve energy efficiency, lighting systems should be designed to:
- maximise natural daylight;
- avoid unnecessarily high levels of illumination;
- incorporate efficient luminaires, control gear and lamps;
- incorporate effective controls.

13.26 See CIBSE guide F for further information.

13.27 For detail regarding illumination levels, designers should consult BS EN 12464-1, BS EN 60598-2-25 and IEC 60598-2-25.

13.28 Lighting within the facility should be coordinated with architectural design. In particular, there should be collaboration to ensure that decorative finishes are compatible with the colour-rendering properties of lamps and that the spectral distribution of the light source is not adversely affected. See also ‘Lighting and colour for hospital design – a report on an NHS Estates-funded research project’ (Dalke et al, 2004).

13.29 Lighting switches should be provided in easily-accessible positions within each area, and at
appropriate locations in corridors and general circulation areas. In areas with multiple luminaires, switching should permit the selection of luminaires appropriate only to that area requiring illumination.

13.30 Where local circumstances permit, the provision of time switches or occupancy controls using infrared, acoustic or ultrasonic detectors should be considered.

13.31 Generally, luminaires should be fitted with fluorescent lamps equipped with low-loss or high-frequency control gear. Where luminaires are infrequently used, or where the design intent of the architect in respect of ambience dictates, compact fluorescent, LV or tungsten lamps may be used.

13.32 Where necessary, general lighting should be supplemented with dedicated task lighting.

13.33 In areas where VDUs are in use, lighting should be designed to avoid any bright reflections from the screen. Generally, the lighting in such circumstances should comply with the guidance given in CIBSE lighting guide (LG) 3.

13.34 Safety escape lighting should be provided on primary escape routes in accordance with the provisions of Health Technical Memorandum 06-01 and BS EN 12464-1.

Special lighting (cardiac operating theatres)

13.35 Detailed guidance regarding the provision of lighting in cardiac operating theatres is given in Health Building Note 26 Volume 1 and BS EN 12464-1.

13.36 Cardiac operating theatres may often have two operating teams working on the patient simultaneously. The number and position of the operating lights should reflect this. The lights should be installed to comply with the requirements of BS EN 60598-2-25.

Special lighting (catheter laboratories)

13.37 Catheter laboratories should be provided with a minor operating light to comply with the requirements of BS EN 60598-2-25 and selected to meet the clinical function of the particular catheter laboratory (see paragraph 13.35). The design of the lamp casing is relatively unimportant other than that it should be easily cleanable.

13.38 General light fittings must be located with reference to the positioning of the X-ray table and tube stand. Very carefully designed locally variable light level control must be provided in the catheter laboratory (fluoroscopic imaging perception can be adversely affected by poor lighting design, which may, for example, fail to eliminate reflection on monitoring screens or allow local dimming).

13.39 Colour-corrected lighting should be provided in all patient areas and the image review room. Level control and avoidance of reflections on monitors in the image review room are essential.

Special lighting (treatment and minor procedures rooms)

13.40 An examination luminaire should be provided over the treatment chair/couch. It should be adjustable in pitch and rotation to allow the beam to be directed locally. Reasonably shadow-free illumination, with negligible heat development, should be provided to avoid injury to patient and staff. The examination luminaires should be manufactured and tested in accordance with BS 4533.

Illuminated warning signs

13.41 At each entrance to the catheter laboratory (except entrances used only by patients under the direct control of staff already inside the room, for example those from walk-through changing cubicles), an illuminated safety sign and a warning lamp must be provided in order to comply with the statutory requirements for radiological protection.

13.42 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.

13.43 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.

13.44 All such signs should be connected to essential supplies where necessary.

13.45 The Medical and Dental Guidance Notes (IPEM 2002) contain detailed advice on warning signs.
Controlled drugs cupboard

13.46 Drug cupboards to contain controlled drugs in a secure manner should be provided to BS 2881.

13.47 Each controlled drugs cupboard should be fitted with a red lamp indicating when the cupboard is unlocked. A repeater lamp should be sited outside the doorway of the room in which the cupboard is located. If appropriate, a secondary repeater should be taken to a permanently staffed station.

13.48 The normal supply for each cupboard should be backed up by a small UPS to cover the short period between mains failure and the generator supply becoming available.

Bedhead services

13.49 Every bed position should incorporate a bed-head unit providing the following:

- 13-amp switched and shuttered socket-outlets;
- medical oxygen and medical vacuum outlets;
- medical compressed air (optional);
- bed-head luminaire switch;
- patient/staff call (see paragraph 13.68 for more details);
- staff emergency call (see paragraphs 13.70–13.71 for more details);
- socket for patient handset;
- IT connection(s);
- radio/TV headset connection;
- telephone connection;
- entertainment system (optional).

13.50 A handset control should also be provided incorporating:

- patient/staff call button;
- reassurance lamp;
- luminaire switch/dimmer control;
- radio/TV selector switch;
- radio/TV volume control.

13.51 Consideration should be given at planning stage to the provision of a commercial system that incorporates all entertainment functions including radio, television, telephone and electronic games.

Fire detection

13.52 Fire detectors throughout the facility should generally be of the ionisation type.

IT and telephone systems

13.53 The approach to provision of IT and telephone infrastructure within the facility may be conditioned by existing systems within the hospital. However, where possible, a structured wiring system as described in the HGN ‘Structured cabling for IT systems’ should be provided. This will permit a unified approach to the provision of cabling for:

- voice systems;
- data systems;
- imaging systems;
- alarm systems.

13.54 Whilst this "universal" cabling system is initially more expensive than separate voice and data systems, the long-term cost of ownership is less.

13.55 In determining the nature of the IT system to be provided it is necessary to identify:

- areas to be served;
- whether structured cabling will be used;
- what density of outlets is to be provided (not less than two per workstation);
- whether wiring will be on a “flood” or “as required” basis;
- special requirements of imaging and picture archiving systems.

Telephone systems

13.56 The extent and complexity of telephone equipment and associated infrastructure will be dependent on the size of the facility. Guidance on telephone systems is contained in Health Technical Memorandum 2055 – ‘Telecommunications (telephone exchanges)’.

13.57 As stated in the section on IT above, it may be beneficial to integrate voice cabling with the structured wiring system for IT if provided.

13.58 Incoming calls to the facility should in general be routed through the reception. However, depending on the size of the establishment, a
limited number of direct dial inwards (DDI) lines may be considered desirable.

13.59 Depending on local policy, at least one ex-directory line should connect directly with the local ambulance services control centre. It should have a distinctive bell, buzzer and colour or other distinctive marking.

13.60 A properly planned telephone system will provide prompt intercommunication facilities between all extensions. Abbreviated dialling can be used for a range of frequently-called extension numbers. Consequently, reasons for providing a separate intercommunication system should be clearly shown.

13.61 Coin- and/or card-operated payphones may be provided. Payphones should incorporate acoustic hoods to facilitate privacy. If payphones are provided, at least one payphone should be suitable for use by disabled persons.

Closed-circuit television systems

13.62 CCTV should be provided, where required, to monitor patients undergoing treatment in restricted areas including CCU. The interference to which such equipment may be subjected should be considered when it is specified, to ensure acceptable electromagnetic compatibility. Care should be taken in the positioning of monitors in order to preserve patient privacy.

Security systems

13.63 Those parts of the facility that are only used during the day, for example OPU, should be protected “out of hours” by an intruder alarm system complying with BS 4737, BS EN 50131-1 or BS 5979 as appropriate.

13.64 Car park areas and the main entrance should be well illuminated at all times. Points of ingress and egress from the facility, and units within it, should be monitored by high-definition CCTVs equipped with pan and tilt facility and capable of producing high-quality images at low levels of light. Positioning of cameras should be determined with care, selecting optimum positioning for maximum field of coverage. Monitors should be sited at a location that is permanently manned whilst the facility is in use.

13.65 Entrances to wards and sensitive areas such as diagnostic and treatment areas should be protected by one of the variety of electronic access control systems available.

13.66 Personal attack alarms should be made available to vulnerable staff, preferably capable of identifying the location of a member of staff in difficulty.

Call systems

13.67 Patient/staff call points should be provided in all spaces where patients may be left alone temporarily, such as consultation/examination rooms, treatment rooms and patient WCs.

13.68 Each call unit should comprise a push button or pull cord, reassurance lamp and reset unit. The audible alarm signal initiated by patients should operate for one second at 10-second intervals, with corresponding lamps lit continuously until cancelled. The alarm should be capable of operation by a disabled person.

13.69 Particular care should be taken when choosing and siting call systems for use whilst a patient is undergoing treatment.

13.70 Staff emergency call points should be provided in all spaces where staff consult, examine and treat patients.

13.71 Emergency call systems should generally comprise a switch (pull to call, push to reset) and reassurance lamp. The audible alarm signal initiated by the staff should operate intermittently at half-second intervals, with corresponding lamps flashing on and off at the same rate.

13.72 A visual and audible indication of operation of each system should be provided at the staff base to give responding staff unambiguous identification of the call source, with a repeater unit in the staff rest room.

13.73 Staff crash call points should be provided in all spaces where patients are at a high risk of suffering a cardiac arrest.

13.74 Crash call systems should comprise a switch (pull to call, push to reset). The switch should be boldly marked “cardiac alarm”.

13.75 The lamps and sounder operation should be as described for emergency call systems.
Public address systems

13.76 Each waiting area may be provided with a simple, dedicated, public address system to advise patients of their turn for consultation. This audio system should, where appropriate, be supplemented by a visual system to cater for the needs of persons with hearing impairment, or whose first language is not English.

Public area entertainment

13.77 Cabling provision should be made for television/video and piped music/radio systems in waiting areas where shown on room data sheets.

Lightning protection

13.78 Protection of the building against lightning should be provided in accordance with Health Technical Memorandum 06-01 and BS 6651.
14 Cost information

Introduction

14.1 For all types of health building, it is important that building costs and revenue expenditure are best value and consistent with acceptable standards. In applying this guidance, the need for economy should always be of prime concern. Where appropriate, space should be shared between similar activities taking place at different times. However, this solution should not be detrimental to the proper functioning of the spaces involved nor to the needs of users.

Departmental Cost Allowance Guides

14.2 Departmental Cost Allowance Guides (DCAGs) related to this HBN are officially notified in ‘Quarterly Briefing’, published by the Department of Health (see http://www.dh.gov.uk). For a full listing of all DCAGs see ‘Healthcare Capital Investment’ on the DH Estates and Facilities Knowledge and Information Portal (KIP) at http://www.dh.gov.uk.

14.3 For general guidance on producing business cases and ensuring robust cost information is obtained to underpin business cases see ‘How to cost a hospital’ (NHS Estates, 2005).

14.4 The attention of the project team is drawn to the Capital Investment Manual (CIM – Business Case Guide) (http://www.dh.gov.uk). This aims to reduce planning work and to encourage the production of sound business case support of both capital and revenue expenditure. Capital works estimates should be based, wherever applicable, on industry norms, such as DCAGs plus a percentage to cover on-costs.

14.5 The DCAGs for this HBN reflect the total building, engineering and accommodation requirements for cardiac services located on an acute hospital site, where common services are shared. Costs are based on a typical two-storey new-build unit on a greenfield site with no planning constraints.

14.6 DCAGs are exclusive of VAT, building and planning fees and all local authority charges, and are based on a location factor of 1.00.

On-costs

14.7 An allowance for on-costs (such as communication space, external works, external engineering services and abnormals) should be added to the DCAGs. Abnormals will largely be determined by site characteristics (such as an inner-city location or poor ground conditions) and by the condition or type of any building to be refurbished.

14.8 Project teams should assess all likely on-cost implications of individual sites and schemes at the earliest opportunity.

Locational factors

14.9 Locational factor adjustments should be applied to works costs (that is, DCAGs plus established on-costs) to take account of local market conditions. For further information, see ‘Quarterly Briefing’ (http://www.dh.gov.uk).

Schedules of accommodation

14.10 The schedules of accommodation show a notional whole department, which highlights the scope for sharing accommodation. The examples are not to be taken as ideal provision for any particular project.

14.11 The examples are as follows:
   • Example 1: Non-surgical unit.
   • Example 2: Surgical unit.
   • Example 3: Surgical unit (includes facilities for treating congenital disorders).

14.12 The schedules of accommodation in this document may be updated from time to time. For the latest version see the schedule of accommodation database on the DH Estates and Facilities Knowledge and Information Portal (http://www.dh.gov.uk).
Dimensions and areas

14.13 The critical dimensions of an area are determined by the spatial requirements of any activities to be carried out within it.

14.14 Planning teams should have data available at the earliest stages of a project to enable the approximate assessment of sizes involved. Areas used for the purpose of establishing cost allowances are listed in the schedules of accommodation at the end of this chapter. These areas do not represent recommended sizes and should not be regarded as specific individual entitlements.

14.15 The efficient planning of a building may necessitate a variation to the areas given. For example, in the refurbishment/conversion of older property:
- rooms tend to be larger than the areas given;
- some rooms may be too small or in the wrong location for efficient use;
- circulation space tends to form a larger than normal proportion of the total area.

Circulation

14.16 All internal corridors, small vertical ducts, spaces occupied by partitions/walls and other space for circulation, are costed in the DCAGs. Provision is also made for a 5% planning zone and 3% engineering zone adjacent to the external walls.

14.17 Circulation figures included in the DCAGs are those anticipated for new-build facilities. Where constraints are encountered, for example in refurbishment/conversion of older types of property, this figure may increase.

Communications

14.18 Hospital “streets”, staircases and lifts (linking spaces) are not included in the DCAGs. Costs related to these elements, along with a suitable space allowance, should be made in the on-costs.

Land costs

14.19 DCAGs are exclusive of all land costs and associated fees. However, costs associated with land costs should be included in business case submissions (as detailed in the Capital Investment Manual) and may therefore have an important impact on the overall cost viability of a scheme.

Engineering services

14.20 The following engineering services are included in the cost allowances (see chapters 10–13 and Activity Data Base for further information). Primary engineering services are assumed to be conveniently available at the boundary of the department.

14.21 Mechanical services:
- heating – low-pressure hot water system;
- ventilation – mechanical supply to, and extraction from, the recovery area and anaesthetic rooms, and other areas requiring mechanical ventilation such as WCs and showers (excludes ventilation plant, such as air handling units or extract fans);
- air-conditioning – to rhythm analysis room, echocardiography reporting room, catheter laboratories and operating theatres. The allowance includes for a separate supply and extract plant per theatre, refrigeration plant and local steam generators (humidification);
- cold water – central supply to service points including drinking water (excludes storage tanks);
- hot water – supply from a central system (excludes storage and generation);
- piped medical gases – oxygen, nitrous oxide, medical air (400 kPA) and surgical air (700 kPA), and medical vacuum (excludes medical compressed air and vacuum plant);
- automatic anaesthetic gas scavenging (AGS) system in the catheter laboratories, minor cardiac procedures room and operating theatres.

14.22 Electrical services:
- departmental distribution boards;
- general lighting, as required by task;
- staff location system;
- emergency luminaires, as appropriate;
- socket-outlets and other power outlets for fixed and portable equipment;
- supplementary equipotential earth bonding;
- uninterruptible power supply (UPS) and equipment;
• fire, security, and Controlled Drug cupboard alarm systems;
• TV/radio wireways;
• telephone internal cabling distribution and outlets (excludes handsets);
• data wireways;
• building management system.

14.23 Equipment (Group 1):
• Controlled Drugs cupboards.
## Example schedules of accommodation

**Based upon a facility comprising:**  
<table>
<thead>
<tr>
<th>Example 1</th>
<th>Example 2</th>
<th>Example 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Non-surgical unit)</td>
<td>(Surgical unit)</td>
<td>(Surgical unit: includes facilities for treating congenital disorders)</td>
</tr>
</tbody>
</table>

### Entrance facilities
- **Departmental from main hospital circulation**
- **External main entrance provision**
- **External main entrance provision**

### Out-patients facilities (dedicated)
- **3 Consulting & examination rooms**
- **9 Consulting & examination rooms**
- **12 Consulting & examination rooms**

### Non-invasive investigations facilities
- **6 Electrocardiography rooms**
- **9 Electrocardiography rooms**
- **9 Electrocardiography rooms**
- **4 Echocardiography rooms**
- **6 Echocardiography rooms**
- **6 Echocardiography rooms**
- **1 Implantable devices clinic room**
- **2 Implantable devices clinic rooms**
- **2 Implantable devices clinic rooms**

### Day case facilities
- **8 places**
- **16 places**
- **16 places**

### Catheter laboratory facilities
- **1 Catheter laboratory**
- **3 Catheter laboratories**
- **3 Catheter laboratories**

### Minor cardiac procedures facilities
- **1 room**
- **2 rooms**
- **2 rooms**

### Cardiac surgery facilities
- **–**
- **4 theatres**
- **4 theatres**

## In-patient facilities: General cardiac facilities (medical and surgical) including high dependency care for adults, children and young people
- **See HBN 4 & HBN 23**
- **See HBN 4 supplement 1**
- **See HBN 57**
- **See HBN 29**
- **See HBN 6**
- **See HBN 15**
- **See HBN 8**
- **See HBN 20**

### Overnight accommodation for parents/families of children together with education/learning facilities for children and young people are covered by HBN 23

### Example 1 | Example 2 | Example 3
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**Out-patients facilities**

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*Children's clinic*
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Support accommodation shared between out-patients and non-invasive investigations facilities
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**Accommodation shared between day case, catheter laboratory and minor cardiac procedures facilities**

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### Activity space

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### Day case facilities

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