HEALTH TECHNICAL MEMORANDUM 67

Building Component Series
Laboratory fitting out system

2005

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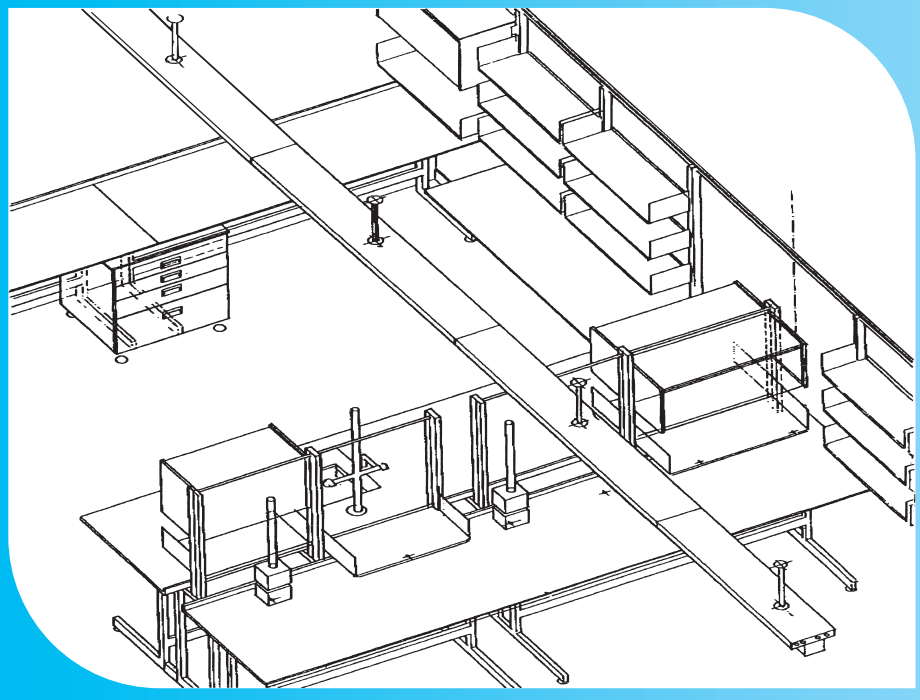

HTM 67
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HTM BUILDING COMPONENTS SERIES

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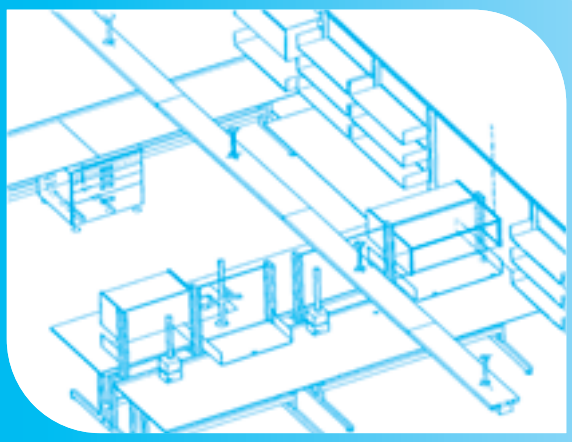

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Contents

1 Introduction

BACKGROUND

1.1 This is one of a series of Health Technical Memoranda which provide specifications and design guidance on building components for health buildings.

1.2 The numbers and titles of the HTMs in the series are:

54 User manual

55 Windows

56 Partitions

57 Internal glazing

58 Internal doorsets

59 Ironmongery

60 Ceilings

61 Flooring

62 Demountable storage system

63 Fitted storage system

64 Sanitary assemblies

66 Cubicle curtain track

67 Laboratory fitting out systems

68 Duct and panel assemblies

69 Protection

71 Materials management modular storage.

1.3 This HTM is intended to supplement HBN 15 – 'Facilities for pathology services'; HBN 29 – 'Accommodation for pharmaceutical services'; BS 3202:1991 'Laboratory furniture and fittings'; and manufacturers' data.

SCOPE AND STATUS

1.4 This HTM offers guidance on the technical design and output specifications of the systems for fitting out laboratories.

1.5 The content of this HTM does not diminish either the manufacturer's responsibility for fitness for purpose of products or the design team's responsibility for selection and application of products to meet project requirements. Design teams are also reminded of their obligations under the Construction, Design and Management (CONDAM) Regulations 1994 (as amended 2000) to ensure safe construction.

1.6 This HTM is concerned mainly with new building work, but much of the information is equally applicable to the replacement of laboratory fitting out systems in existing buildings.

RELATIONSHIP TO OTHER DATA

1.7 The main sources of data used in the preparation of this HTM are listed in the References section.

1.8 In particular, the attention of users and manufacturers is drawn to the performance requirements for the components set out in Chapter 4 "Performance".

1.9 This HTM was prepared for publication in January 2005. After this date, readers should ensure that they use the latest or new edition of all building legislation, British Standards etc, which may post-date the publication of this document.

1.10 First preference should be given to products and services from sources which have been registered under BSI Quality Assurance procedures or other certification schemes. Suppliers offering products other than to British Standards should provide evidence to show that their products are at least equal to such Standards.

1.11 Any enquiries regarding the technical content of this HTM should be e-mailed to nhsestates@dh.gsi.gov.uk

2 System description

GENERAL PRINCIPLES

2.1 This HTM describes a range of components for use in laboratories and offers advice on their use, together with guidance on the installation of services.

2.2 The selection of appropriate laboratory fittings with their work surfaces, related storage and services, the wall, ceiling and floor finishes, the special building characteristics and the need to accommodate ancillary equipment and fittings for a pathology laboratory, is an extremely complex operation.

2.3 Laboratories may accommodate a wide range of specialist departments including haematology, chemical pathology, histopathology, microbiology etc. The fitting-out system described in this document is suitable for general use in these laboratories and also in pharmacies.

2.4 Worktops in a variety of heights, widths, depths and materials are supported by cantilevered structural frames giving unobstructed knee space, allowing users freedom of lateral rearrangement of under-bench storage and work positions. Workbenches can be free-standing on C-frames or fixed in island or perimeter layouts. They are suitable for a full range of laboratory work.

2.5 The fixed cantilever bench system permits layouts to be created to suit specific planning requirements of laboratory users.

2.6 Suspended and mobile under-bench units allow users total freedom to rearrange the under-bench zone and also easy access for cleaning.

2.7 Racking, bins or shelves for bulk storage may be fixed to walls or free-standing. Where possible, separate storerooms close to the point of use should be provided.

2.8 Machine benches or stands are included for heavy analytical or processing machines.

2.9 The range of components has been designed to be versatile, ergonomically correct, robust and durable, hygienic, and capable of complying with health and safety regulations. Value for money has been a prime consideration.

2.10 The components can be assembled in a number of standard design options which satisfy most common user requirements, and these are set out in paragraphs 5.7–5.37.

3 Design requirements

WORKBENCHES

3.1 Work surfaces are available in materials listed in paragraphs 3.10–3.16 and may be fitted with integral sinks and drip-cups.

3.2 All worktops are supported by a cantilevered structural frame giving users maximum freedom of lateral rearrangement of the under-bench storage and work positions.

3.3 The 920 mm workbenches will permit domestic refrigerators to be located underneath.

3.4 Workbenches can be free-standing, giving the users the choice to rearrange the layout as desired (see paragraphs 5.8–5.14), or fixed (see paragraphs 5.15–5.32).

3.5 C-frame movable workbenches can be free-standing or linked either side-by-side or back-to-back to form an island or peninsula.

3.6 When in the last configuration, inverted T-shaped linking devices can be added which incorporate aluminium slotted uprights (see HTM 62 – 'Demountable storage system') to allow components to be added providing above-bench storage. A simple linking device is used where above-bench storage is not required.

3.7 Fixed workbenches can be either perimeter (supported by a wall) or peninsulas or islands (accessible from either side).

3.8 Integral storage and service ducts can be accommodated above work surfaces (see paragraphs 5.7–5.37).

3.9 Under-bench storage can be either mobile on castors, suspended under the worktops or placed on an under-bench platform.

MATERIALS FOR SURFACES OF WORKTOPS AND SINKS

3.10 Materials are available which vary in their resistance to corrosive chemicals and staining, abrasion and impact resistance and suitability for wet or dry activities, clerical work, inspection etc (see paragraphs 4.15 and 5.43–5.54).

3.11 Edges of worktops may be finished in a variety of ways. The cast resin materials may be moulded to a number of profiles. Hardwood and cast resin materials may be machined to designed profiles. The wood-based board materials may have an edging applied by bonding processes. Linoleum and plastic-laminate worktops can also be post-formed to curved profiles.

3.12 Wet worktops can be provided with raised containment edges. These are essential where radioactive substances are being used.

3.13 Certain materials need supporting on a substrate or by integral framing.

3.14 Materials for worktops include:

- standard-grade laminate;
- solid-colour laminate;
- post-formed laminate;
- linoleum;
- phenolic resin;
- solid hardwood;
- toughened glass.

3.15 Materials that can be fabricated, cast or moulded to form worktops with or without integral sinks, drip-cups and drainers include:

- cast polyester resin;
- cast acrylic resin;
- cast epoxy resin;
- polypropylene;
- stainless steel;
- ceramic.

3.16 Some resin-based worktop materials may contain fillers.

STORAGE

3.17 In addition to the storage of operational equipment and supplies, a disposal hold must be provided.

Under-bench units

3.18 Domestic-type refrigerators can be accommodated under the 920 mm high worktops.

Mobile under-bench units

3.19 The fitting of energy-absorbing buffer wheels may be desirable for units which are expected to be moved regularly.

- 650 mm high unit to fit under 720 mm high benches;
- 850 mm high unit to fit under 920 mm high benches;
- carcasses that are 350 mm and 500 mm wide have single doors hinged left or right;
- the 600 mm, 700 mm and 1000 mm wide units have pairs of doors.

Static under-bench units

3.20 These are standard 650 mm and 850 mm high units without castors.

- 550 mm units to be suspended under 920 mm high benches in options 1, 2, 3 and 4 (see paragraphs 5.8–5.23);
- 750 mm units to be placed under 920 mm high benches in options 5 and 6 (see paragraphs 5.24–5.32);
- 150 mm, 350 mm and 550 mm lower storage components from the HTM 63 – 'Fitted storage system' range may also be suspended under worktops.

Under-bench storage with top-hung sliding doors and fitted under sinks

3.21 This is for use with all options, either 550 mm or 750 mm (nominal height); widths can be made to suit project requirements.

Over-bench storage

3.22 These units are supported by aluminium slotted uprights and are compatible with HTM 62 – 'Demountable storage system'. They are optional on free-standing, peninsular and island workbenches. They may incorporate horizontal service ducts.

3.23 Storage components, cupboards, shelves etc are interchangeable with the wall-hung storage.

Wall-mounted storage

3.24 Shelving, racking, cupboards or hooks, either fixed or suspended, are as described in HTM 62 – 'Demountable storage system'.

Wall cupboards with top-hung sliding glass or solid doors

3.25 These are used as shelving, racking, bins and floor-track-mounted mobile systems.

3.26 Storage will be required for a wide range of materials, specimens, chemicals (solid and liquid), apparatus, equipment, tools and clothing.

3.27 A number of proprietary storage systems are available.

3.28 BS EN 14056:2003 gives general guidance on storage.

Ventilated specimen storage

3.29 In addition to general room ventilation, special provision must be made for the storage of formaldehyde and specimens of organic matter stored in formaldehyde or other preservatives. This usually takes the form of ventilated cupboards.

Gas and flammable liquids storage

3.30 External storage for bulk supplies of gases and flammable liquids must be provided as described in HBN 15 – 'Facilities for pathology services' and Firecode Part 3: 'Supporting guidance note 8 – Laboratories'.

3.31 Local storage of flammable liquids and acids will need specially-designed storage units.

ANCILLARY ITEMS

3.32 Laboratories require a range of equipment which is highly specialised and is complementary to the benches and storage units forming the main content of this HTM.

3.33 Whilst this document cannot give detailed recommendations on such equipment, some outline guidance or pointers to other existing guidance is given to enable the designers of a laboratory to make provision for these pieces of equipment.

3.34 These items include:

- safety cabinets (see HBN 15 – 'Facilities for pathology services');
- fume cupboards (see HBN 15 – 'Facilities for pathology services');
- ventilated or extract benches (see paragraph 5.42).

RECEPTION COUNTER/PASS-THROUGH HATCH

3.35 Reception facilities for patients and specimens will require separate hatches.

3.36 These are normally of sliding glass construction about 1200 mm wide, lockable, and located in a prepared opening. Reception hatches may need to be fitted with a security grille and may be required to be of fire-resisting construction.

3.37 On the laboratory side of the hatch, a bench should be provided, generally 920 mm high with an appropriate work surface. A shelf is sometimes required on the public side, projecting about 300 mm and level with the bench on the laboratory side.

3.38 A “night safe” aperture is often fitted for out-of-hours delivery of specimens.

DISPOSAL HOLDING

3.39 Facilities for the temporary holding of waste matter to be disposed of are described in HBN 15 – ‘Facilities for pathology services’.

4 Performance

4.1 Laboratory workbenches and storage units should conform to the recommendations for performance set out in BS 3202-2:1991.

4.2 Three grades of performance have been established in this British Standard as follows:

- Grade G "general use" – appropriate for general laboratory use (with light loaded storage) and in use for approximately eight hours per day;
- Grade H "heavy use" – appropriate for heavy laboratory use including up to 24 hours' use per day and some rough treatment and careless handling;
- Grade S "severe use" – appropriate for severe laboratory use including heavy storage loads, up to 24 hours' use per day and subject to misuse.

4.3 These grades may be appropriate for the strength and stability of benches and other fittings. Generally, heavy duty grade will be required.

4.4 However, these grades and their test ratings as set out in the BS do not readily fit the needs and practices in medical pathology laboratories for the performance of surfaces.

4.5 The recommended performance for these laboratories is set out in paragraphs 4.7–4.30 and in the design selection matrices in paragraphs 5.43–5.54. Table 1 relates these recommendations to the ratings in the BS. Additional requirements from HTM 63 – 'Fitted storage system' which may be relevant to pathology laboratories are also included in Table 1.

4.6 Bench usage in hospital pathology laboratories is set out in paragraphs 4.8–4.14.

STRENGTH AND STABILITY

4.7 Workbenches, storage units and shelving should comply with the recommendations for strength and stability set out in BS 3202-2:1991, and should meet the required standards when tested in accordance with the methods set out in this Standard and BS 4875 parts 5, 7 and 8.

BENCH USAGE

4.8 The variety of uses, substances and occurrences to which the benches will be subjected are grouped as follows:

- Dry work – administrative (Da). This includes using the surface for writing, reading, using computers.
- Dry work – general (Dg). This includes the previous item, plus using microscopes, examining specimens and slides, dry chemical processes and analytical machines, maintenance of equipment. Minor spillages of water or chemicals may take place from time to time, and occasional light cutting and abrasion may take place.
- Wet work – general (Wg). This encompasses regular spillages of water and chemicals, corrosive, non-corrosive and biological materials, wet processes, light straining, analytical and processing machines; occasional abrasion may take place on some work surfaces.
- Wet work – heavy (Wh). This includes the usage in "wet work – general" and heavy chemical spillages and staining, with regular cutting and abrasion.

4.9 Colour and tone may be important where examination of slides or specimens takes place. The choice will largely depend on the user. Therefore, the decision will need to be taken at the design stage in consultation with all stakeholders.

4.10 Work surfaces may need to take the load of equipment, processing and analytical machines, although machine stands, either mobile or fixed, should be specified for these when use is continuous or machines need regular servicing or are heavy.

4.11 A few surface materials may be able to accept all of these uses. Some surfaces may resist certain acids or stains, but not others. Some materials may resist abrasion and cutting, while others may suffer moderate wear or staining, but be capable of being satisfactorily resurfaced. Other surface materials may only be suitable for certain of the activities.

TABLE 1 SURFACE RATINGS

Test method ratings in BS 3202 and BS 3962		Minimum performance Work surfaces				Others
		Da	Dg	Wg	Wh	
B	Resistance to surface penetration (tool blunting)	2*	3*	4*	5*	3
C	Impact (19.1 mm ball)	4#	4#	4#	5#	3
D	Wet heat 55° Centigrade	4	4	4	4	2
	70°	3	3	3	3	2
	85°	3	3	3	3	2
	Dry heat 85°	–	–	–	–	2
	100°	–	–	–	–	2
	120°	3	3	3	3	–
	140°	3	3	3	3	
	160°	3	3	3	3	
E	Resistance to cold liquids					
	Acetic acid	3	4	4	5	3
	Acetone	3	4	4	5	3
	Ammonium hydroxide	–	4	4	5	3
	Aqua regia	–	2	4	5	2
	Butyl acetate	3	4	4	5	3
	Dimethylformanide	–	2	4	5	5
	Disinfectant (phenol)	4	4	4	5	3
	Disinfectant (chloro)	4	4	4	5	3
	2-ethoxyethanol	–	2	4	5	2
	Gentian violet	–	2	4	5	2
	Hydrogen peroxide	–	2	3	3	2
	Nigrosine	–	4	4	5	3
	Olive oil	3	3	–	–	3
	Potable spirit	3	4	4	5	3
	Potassium permanganate	–	4	4	5	3
	Silver nitrate	–	4	4	4	3
	Sodium hydroxide	–	4	4	5	3
	Sulphuric acid (concentrated)	–	–	2	3	2
	Sulphuric acid (diluted)	–	2	2	5	2
	Toilet spirit	3	3	4	5	3
	Xylene	–	4	4	5	3
F	Resistance to surface wear	150 for all grades				
H	Resistance to surface heating	3 for all grades, no blistering				
L	Bond quality	No failure of the glue line to occur such that any area of either the surfacing material or substrate greater than 40 sq m is free from adherent matter derived from substrate or surfacing material				
M	Adhesion of edging material					
	40° Centigrade	4 for all grades				
	50°	3 for all grades				
N	Resistance to humidity	No visible deterioration, 0.8 mm max increase in panel thickness				
P	Water ingress	No visible deterioration, no blistering				
Q	Effects of flooding	No visible deterioration, 0.8 mm max increase in panel thickness				
R	Worktop and work-surface replacement	Record result				
S	Impact (42.8 mm ball)	Record result				

Notes:

For convenience, the explanation of performance ratings shown above is set out below:

Rating 5 No visible change (no damage)

Rating 4 Slight change in lustre, visible only when the light source is mirrored in the test surface on or near the mark and is reflected towards the observer's eye, or a few isolated marks just visible

Rating 3 Slight mark, visible in several vieing directions, eg almost complete disk or circle just visible

Rating 2 Strong mark, the sturcture being largely unchanged

Rating 1 Strong mark, the structure of the surface being changed or the surface material being wholly or partially removed or the filter paper adhering to the surface

These levels apply to hard work surfaces only. Record results for assessment of tool blunting propensity (soft work surfaces only).

* These levels apply to hard work surfaces only.

4.12 Scratches and cuts can be satisfactorily removed or smoothed out on some surfaces using abrasive pads, sanding machines or scrapers.

4.13 Cutting boards should be provided and used to avoid predictable damage to bench surfaces.

4.14 Cleaning off after staining should be done as soon as possible, and can be satisfactorily carried out by the use of a number of substances and methods familiar to most laboratory scientific staff, depending on the surface material and the stain. These include methylated spirit, acid alcohol, xylene and domestic oven-type cleaners.

Surface finishes

4.15 Surfaces and finishes of workbenches, storage units and shelving should conform to the recommendations of BS 3202-2:1991 and Table 1, and should meet the required standards when tested in accordance with the methods set out in BS 3202-2:1991, BS 3962-5:1980, BS 3962-6:1980, BS EN 12720:1997, BS EN 12721:1997 and BS EN 12722:1997. These methods of test and ratings required are set out in Table 1.

Joints in work surfaces

4.16 Any joints in work surfaces must be made using epoxy resin grout or other suitable material to give a surface which will not crack, retain dirt or foreign matter, and will not promote or sustain the growth of harmful pathogenic agents.

Suitability of surface materials

Linoleum

4.17 This is traditionally used for administrative dry work. It is also suitable for general dry work where occasional spillages of water and some chemicals may occur. It has moderate resistance to staining and may be resurfaced after minor surface wear.

Laminate

4.18 This is for general dry work with occasional spillages of water and some chemicals, moderate resistance to staining, abrasion and cutting.

Cast epoxy resin

4.19 Cast epoxy resin is highly resistant to all dry, wet and chemical uses. It is also highly resistant to staining, abrasion and cutting. It can withstand wet and dry heat, and may be cast or fabricated into work surfaces with integral sinks etc. It is extremely hard-wearing, and the surface can be easily cleaned or reinstated.

Cast polyester resin with fillers/cast acrylic resin with fillers

4.20 Both of these are resistant to most dry, wet and chemical uses; they give moderate resistance to staining, abrasion and cutting, and may be satisfactorily resurfaced. Sinks may be bonded in.

Phenolic resin

4.21 Phenolic resin is sometimes known as solid core laminate. The facing surface is resistant to most dry or wet chemical processes; it has good resistance to some staining in some colours and moderate resistance to abrasion and cutting, but the coloured facing surface can wear through.

Polypropylene

4.22 Polypropylene has good resistance to most dry, wet and chemical processes; it has good resistance to staining but poor resistance to abrasion and cutting. It is subject to thermal expansion and contraction and must be supported by a substrate. Integral sinks may be bonded in under factory conditions.

Solid hardwood

4.23 Solid hardwood of a density of at least 580 kg m–3 is used for general dry work with occasional spillages of water or chemicals. It will accept wet work and some abrasion and cutting, but will require regular resurfacing. It may not be acceptable for use with organic materials.

Ceramic and toughened glass

4.24 Both are suitable for dry and wet work and with chemicals. They have good resistance to staining but limited resistance to impact, abrasion and cutting. Sizes of panels are limited; joints are required in work surfaces.

Stainless steel

4.25 This is suitable for wet or dry work. Staining and chemical resistance is limited; it has moderate resistance to abrasion and cutting; acid resistance grade 316 must be used.

Edges

4.26 Edges to work surfaces, doors and drawer fronts and all exposed edges of carcasses must be resistant to wear and tear, impacts and liquids in normal use. They must satisfy the same test standards as the main surfaces of the components, particularly tests C, D, F, L, M, N, P and S.

4.27 Edges can be cast, moulded or machined from the solid in the resin materials with appropriate profiles. Profiled and post-formed edges in linoleum or plastic

laminate should provide a similar standard of performance as the main surface of the component.

4.28 Wet worktops can be provided with raised containment edges. These are essential where radioactive substances are being used.

4.29 PVC edges 2–4 mm thick and applied by an edge-banding machine, and moulded polyurethane edges where applied to timber-based board materials, can give a high performance.

4.30 Hardwood edgings are generally only suitable for use in administrative, dry-work situations.

RESURFACING TEST

4.31 In addition to BS 3202-2:1991, when a work surface has been renovated by refinishing or resurfacing, the surface should be retested in accordance with performance requirements set out in paragraphs 4.8–4.15, and should achieve the same level of performance as in the original test.

TEST SAMPLES

4.32 Test samples should be in accordance with BS 3202-2:1991.

TOLERANCES

4.33 Manufacturing and assembly tolerances should be in accordance with BS 3202-2:1991.

SURFACE SPREAD OF FLAME

4.34 When tested in accordance with BS 476-7:1997, painted and lacquered surfaces should achieve a minimum of Class 4, and melamine surfaces Class 3.

SINKS, DRIP-CUPS ETC

4.35 Sinks forming part of a work surface should be integral with the work surface. Any bonding or jointing must be carried out under workshop conditions to provide a homogeneous assembly.

IRONMONGERY FOR FITTINGS AND FURNITURE

4.36 All ironmongery should be corrosion-resistant. Hinges should enable doors to open through 270°, and when tested on storage unit doors must comply with the requirements of BS 4875-7:2001.

4.37 Handles and pulls for doors and drawers should not be of a form which could act as a reservoir for spillages from work surfaces above, and should not be liable to cause injury to users or catch on clothing.

4.38 Locks are not required generally on storage units in laboratories; security is better dealt with by locking rooms or departments. Locks should only be fitted where demanded by statutory requirements or special local conditions.

RADIOACTIVE SUBSTANCES

4.39 Advice should be sought from the regional radiation protection adviser when radioactive substances are to be used (see http://www.nrpb.org).

5 Design application

LAYOUT DESIGN

5.1 The range of fitting out components contained in this HTM has been developed to cater for most layouts and all the configurations described in BS EN 14056:2003.

5.2 Workstation layouts can be wall-related, peninsular, island or a combination of the three.

5.3 The use of machine benches for cumbersome analytical and processing equipment is strongly recommended. Access to the backs of some machines may be required for maintenance, in which case braking castors should be fitted.

5.4 Mobile workstations and mobile sink units may be used in conjunction with all options.

5.5 Guidance regarding layout and ergonomic data for benches and storage is contained in BS EN 14056:2003 and HBN 15 – 'Facilities for pathology services'.

5.6 Consultation should take place with fire officers, radiation protection advisers, statutory bodies and other relevant specialists regarding layouts. Subsequent rearrangement or change in use may require approval.

DESIGN OPTIONS

5.7 A variety of design options can be arrived at using the component and service arrangements described.

Option 1

5.8 Loose C-frame workbenches with piped and wired services are fed from overhead outlets to relocatable bollards on the work surfaces.

5.9 Drainage is via flexible wastes to floor points.

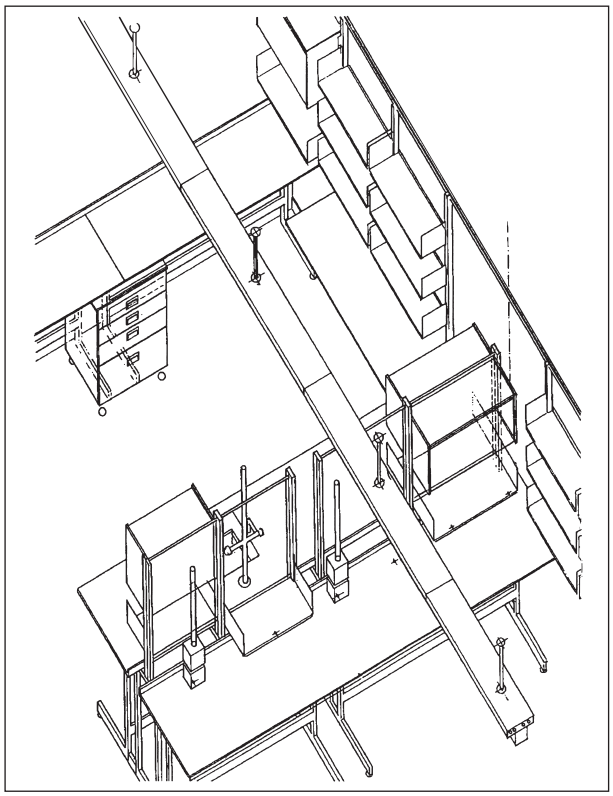
5.10 This option gives total adaptability which can be carried out by the laboratory staff without disrupting the work of the laboratory.

Option 2

5.11 Loose C-frame workbenches with services and drainage are attached below work surfaces.

5.12 Outlets are through relocatable bollards on the work surfaces.

Figure 1 Option 1



5.13 Drainage is either through flexible pipes to floor points or hard-piped to the perimeter wall.

5.14 Adaptation is by laboratory staff in conjunction with local plumbers, with little disruption to the work of the laboratory. (Note: options 1 and 2 allow only single-sided operation on peninsular benches; all the other options allow pass-across operation.)

Option 3

5.15 Cantilevered workbenches are bolted to floors and walls, with piped service and drainage runs cased-in below work surfaces.

5.16 Taps and valves are deck-mounted.

5.17 Wired services are in horizontal distribution ducts 300–450 mm above bench level, leaving a clear worktop.

5.18 Rearrangement of benching requires the services of several building and specialist trades and may involve full or partial closure of a laboratory.

Option 4

5.19 Cantilever workbenches are bolted to floors and walls.

5.20 All services are housed in horizontal distribution ducts 300–450 mm above the work surfaces, leaving a clear worktop.

5.21 Drainage is via under-bench casing.

5.22 Rearrangement of benching requires building and specialist trades and will involve closure of the laboratory.

5.23 Under-bench storage to options 1–4 can consist of mobile units on castors or carcasses suspended below worktops.

Option 5

5.24 C-frame benches are bolted to the floor; a fixed plinth/shelf covers the feet, with under-bench units standing on it.

5.25 Taps and valves are desk-mounted. Wired services are in horizontal distribution ducts 300–450 mm above bench level, leaving a clear worktop.

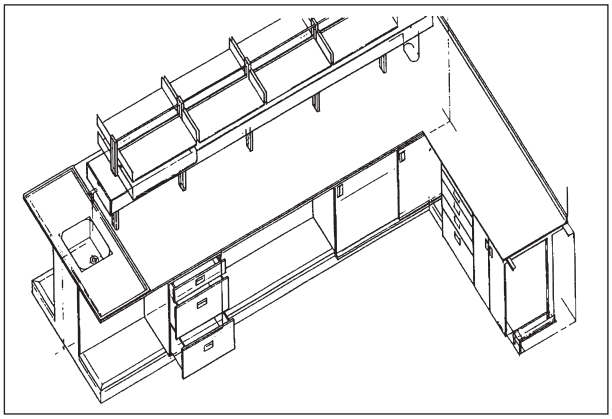
5.26 Under-bench rearrangement can be carried out by the users.

5.27 Rearrangement of benching requires building and specialist trades and will involve closure of the laboratory.

Option 6

5.28 C-frame benches are bolted to the floor; a fixed plinth/shelf covers the feet, with under-bench units standing on it (see Figure 2).

Figure 2 Option 6



5.29 All services are housed in horizontal distribution ducts 300–450 mm above the work surfaces, leaving a clear worktop.

5.30 Under-bench rearrangement can be carried out by the users.

5.31 Rearrangement of benching requires building and specialist trades and will involve closure of the laboratory.

5.32 See Figures 3a and 3b for example arrangements of design options 1–6.

Option 7

5.33 Workstations are suspended from the structure above.

5.34 Supply services are fed from above and distributed via a horizontal duct 300–450 mm above the work surface.

5.35 Drainage is into floor points.

5.36 All under-bench storage is made up of mobile units.

5.37 Rearrangement of benching requires building and specialist trades and will involve closure of the laboratory.

ERGONOMICS

5.38 Advice on layout space requirements is given in BS EN 14056:2003 and HBN 15 – 'Facilities for pathology services'.

5.39 Workbenches should follow the recommendations in BS EN 14056:2003 and be constructed to the following dimensions:

- Worktop heights:
  - (i) sitting: 720 mm;
  - (ii) standing or sitting on high stools: 920 mm.
- Worktop depths: 600 mm and 750 mm.

5.40 Storage for apparatus, equipment, materials and papers should be located at levels convenient to the users; advice is given in BS EN 14056:2003 and HTM 63 – 'Fitted storage system'. The designs for storage units in this HTM comply with these recommendations.

FITMENTS WITH EXTRACT CAPABILITY

5.41 HBN 15 – 'Facilities for pathology services' gives guidance on microbiological safety cabinets and fume cupboards.

Figure 3a Design options (see also Figure 3b)

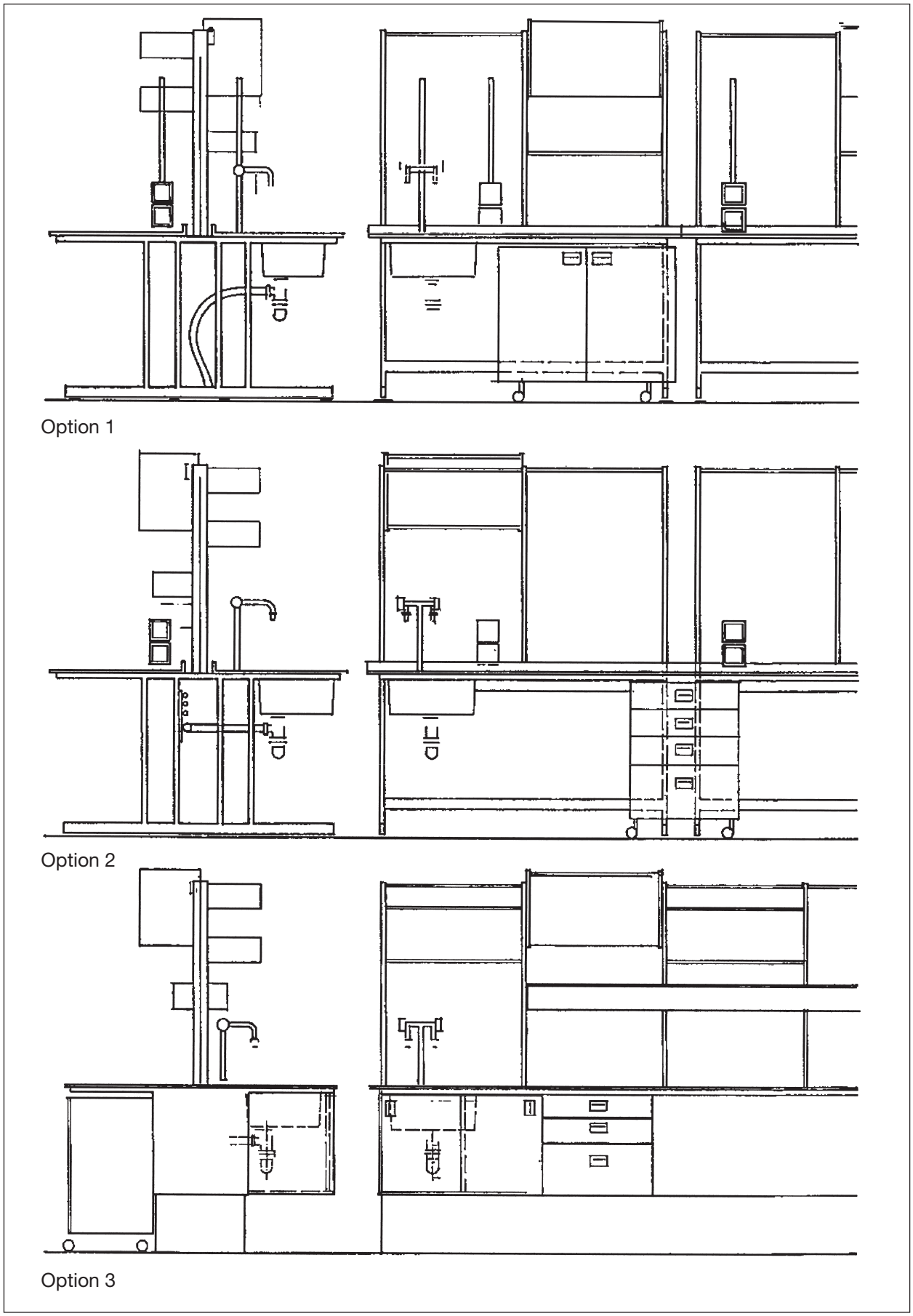
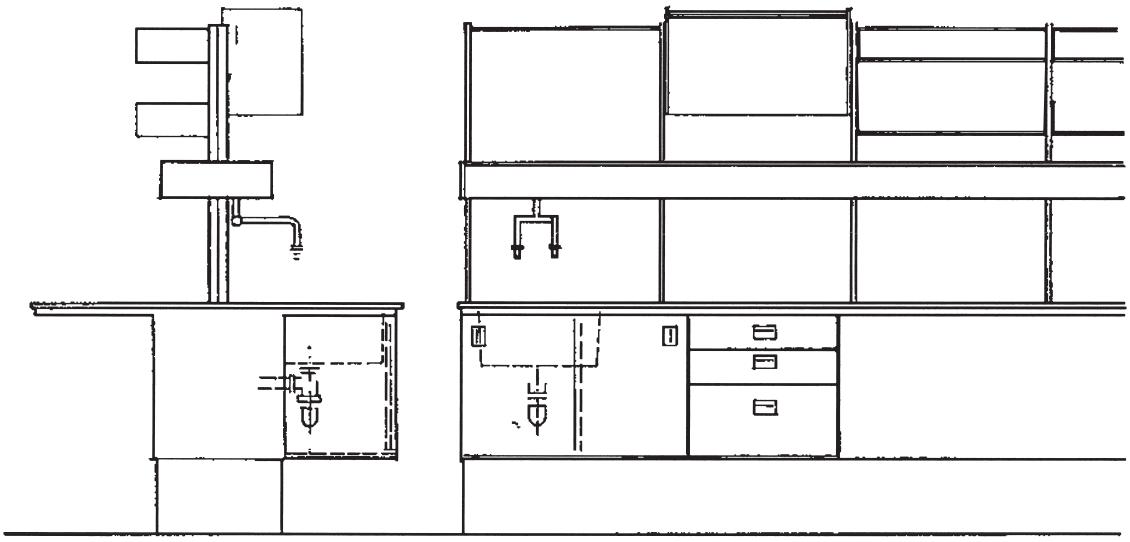
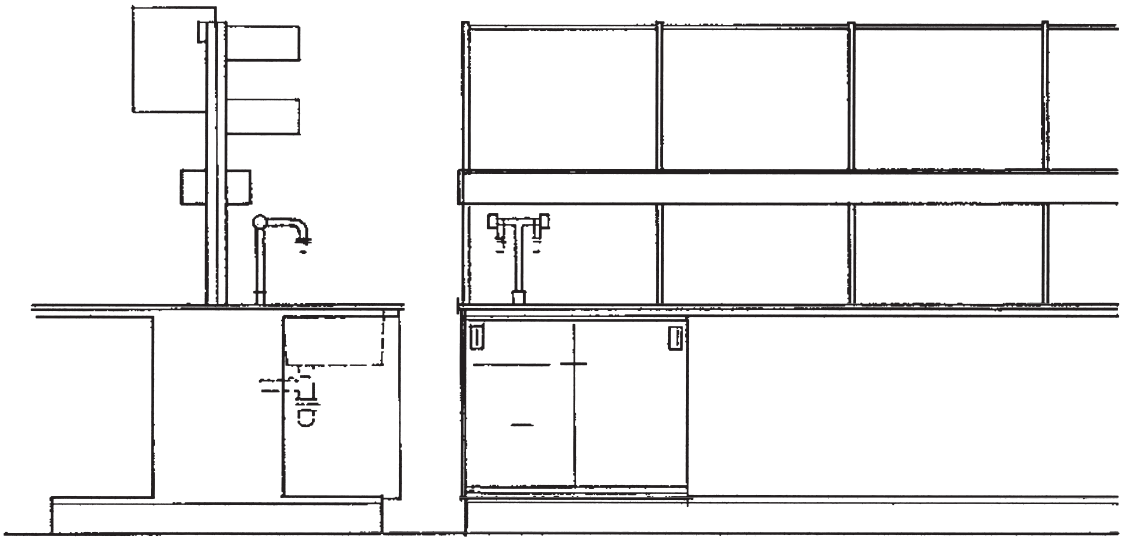


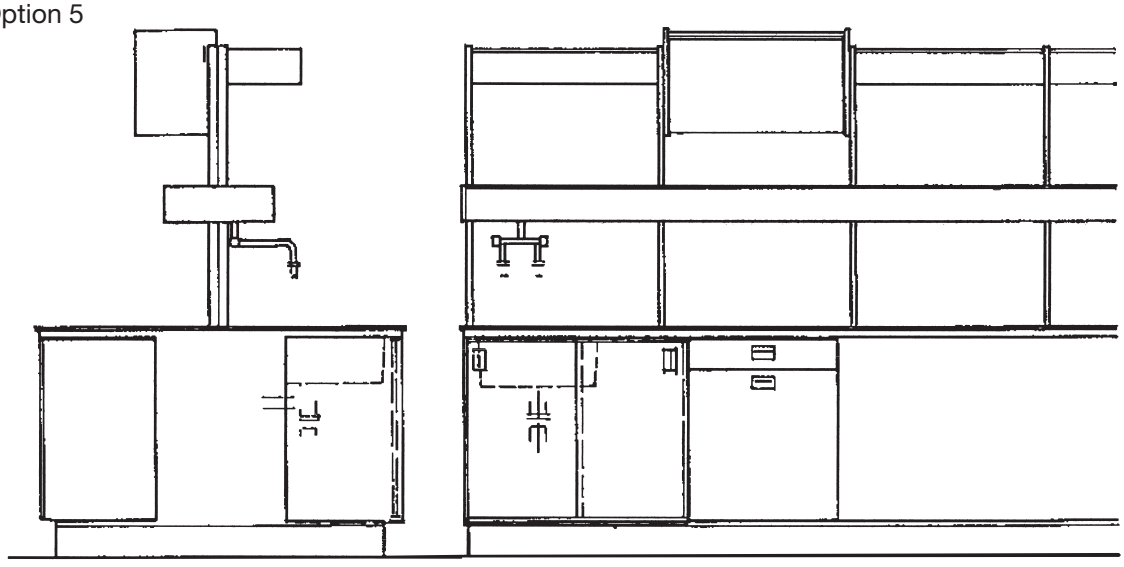
Figure 3b Design options (continued from Figure 3a)



Option 4



Option 5



Option 6

Ventilated/extract dissecting tables

5.42 Workbenches – single- or double-sided – have perforated worktops with downdraught ventilation that takes chemical and other noxious fumes and particles away from the operators. It will be necessary to carry out a COSHH assessment to ascertain what hazards are present before steps can be taken to reduce the associated risks.

DESIGN SELECTION MATRICES

5.43 The selection of appropriate laboratory fittings, with their work surfaces, related storage and services, the wail ceiling and floor finishes, the special building characteristics and the need to accommodate ancillary equipment and fittings for a pathology laboratory, is an extremely complex operation.

5.44 The process involves lengthy dialogues between architects, designers, engineers and the users, that is, the pathologists and medical scientific officers.

5.45 A wide and deep range of background knowledge is required. Laboratories are not built in large numbers; consequently, participants in the design team may have had little previous experience in briefing for the design and construction of a laboratory project.

5.46 To assist this design process, two design selection matrices (Tables 2 and 3) have been provided. They provide a starting point for project design. They are intended to enable a detailed brief to be prepared at an early stage and to act as a checklist for the designers.

5.47 The lists of items and recommended selections are typical only, and final selections must be carefully checked with project teams.

5.48 Table 2 shows the relationship of the rooms in a pathology laboratory with:

- the activities performed in the rooms;
- wall, ceiling and floor finishes (see HTM 56 – ‘Partitions’, HTM 60 – ‘Ceilings’ and HTM 61 – ‘Flooring’);
- certain special building characteristics.

5.49 Table 3 shows the relationship of the activities with:

- services;
- ancillary equipment;
- workbenches, machine stands and sinks;
- storage.

5.50 In certain columns, it will be necessary for options to be indicated by a value or mnemonic code. These are:

- grade of workbench or machine stand – G, H or S (see Chapter 4 “Performance”);
- colour/tone of work surface – L or D (light or dark).

5.51 To illustrate how these matrices may be used, examples have been filled in as would be appropriate for a typical laboratory installation, with the intention of providing general guidance in the provision of fittings and services etc, and at a later stage to form a starting point for project design.

5.52 They can also be used in blank form as questionnaires or checklists in the briefing and detail design process between the architect, design team and laboratory users.

5.53 When they are used in this way, most boxes can be used as tick boxes but, in a few instances, a selection of grade, quality or size etc must be made. A code or figure should be inserted using the references set out in the earlier sections of this document. In some other instances, more than one option or characteristic may be required. For example, in some laboratories it will be necessary to have workbenches of both heights for use when sitting in low chairs, high stools or standing. Both boxes must be ticked to show this.

5.54 At the later stages of the project, these matrices can be built up into fully developed schedules of fittings etc.

TABLE 2

Relates to Activities, Finishes and Building Characteristics

ACTIVITIES	Patient waiting area	Patient reception	Consulting/examination room	Venepuncture room	Patient/specimen WC	Specimen reception	Out-of-hours facility	General office	Computer room	PLMSO/co-ordinators' room	Secretaries' room	Bulk store/storekeeper's room	External flammable materials/gas store	Autoclave area	Central washup	Minor equipment maintenance	Disposal holding area	Cleaner's room/store	Staff change/WC/shower	Staff room	Technical library/seminar room	Duty staff beroom/WC/shower	Consultants, junior medical staff office	SCLMSO office	Store, chemicals/slides/specimens/equipment	General laboratory	Special tests laboratory
Ablutions			•	•	•		•			•									•			•	•	•		•	•
Automated analysis/system																										•	•
Category 3 work																											
Centrifugation						•																				•	•
Chemical disposal, bulk																										•	•
Chemical tests, manual																										•	•
Computing	•	•				•		•	•	•	•										•		•	•		•	•
Equipment maintenance														•		•										•	•
General laboratory work														•									•	•		•	•
Media preparation																										•	•
Microscopy																					•					•	•
Overnight duty																						•					
Packaging and posting, specimens						•																					
Preparation of liquids																										•	•
Preparation of specimens																											
Radio-isotopes handling/disposal																											
Slide preparation				•																						•	•
Solvent handling																	•									•	•
Specimen cut-up (Histopathology)																											
Specimen disposal														•			•										
Specimen reception						•																					
Staining																										•	•
Sterilization														•													
Storage, general												•												•			
Storage, bulk corrosive																											
Storage, inflammable													•														
Weighing																										•	•
Writing (administrative)		•	•			•	•	•	•	•		•									•	•	•	•		•	•
Writing (laboratory)				•		•	•							•	•	•							•	•		•	•
FINISHES																											
Walls	5	5	3	3	5	5		6	6	6	6	6			3	5	3	3	5	6	6	5	6	6	6	3	3
Ceilings	4	4	3	3	5	4		6	6	6	6	6			3	2	3	5	5	6	6	6	6	6	6	3	3
Floors	6	6	6	3	2	6		6	6	6	6	5			3	3	5	2	5	5	6	3/6	6	6	5	3	3
BUILDING CHARACTERISTICS																											
Airtightness																											
Radiation source																											
Sound source						•																	•		•		
Sound insulation required																											
Vibration free																							•		•		
Black-out facility																											
High security						•	•															•			•		

TABLE 2 (contd)

Relates to Activities, Finishes and Building Characteristics

ACTIVITIES	Environmental/public health laboratory	Containment level 3 laboratory	Bacterial/viral/antibiotic serology lab	Blood culture laboratory	Media preparation/plate pouring	Weighing/reagent preparation area	Isotope laboratory	Immunology laboratory	Coagulation	Gross cutting/histopathology/specimen processing	Specimen storage/disposal	Slide block/store	Processing laboratory/cytology	Screening laboratory	Darkroom/photography	Blood grouping laboratory	Blood cross-matching laboratory	Blood/blood products issue	Tissue typing laboratory
Ablutions	•	•	•	•	•		•	•	•	•	•		•	•		•	•		•
Automated analysis/system	•	•	•	•	•		•	•	•				•			•	•		•
Category 3 work		•											•						
Centrifugation	•	•	•	•			•	•	•				•			•	•		•
Chemical disposal, bulk				•				•	•										
Chemical tests, manual	•	•	•	•		•		•	•		•		•			•	•		
Computing	•		•	•			•	•	•	•	•		•	•		•	•	•	•
Equipment maintenance	•	•	•	•	•		•	•	•	•	•		•			•	•		•
General laboratory work	•	•	•	•		•	•	•	•	•			•			•	•		•
Media preparation	•			•	•	•		•	•										
Microscopy	•	•	•	•				•	•					•		•	•		•
Overnight duty																			
Packaging and posting, specimens																•	•	•	
Preparation of liquids				•	•			•	•				•			•	•		•
Preparation of specimens																			•
Radio-isotopes handling/disposal							•												
Slide preparation	•			•				•	•				•						
Solvent handling	•			•				•	•	•			•						
Specimen cut-up (Histopathology)										•									
Specimen disposal																			
Specimen reception																			
Staining	•	•		•				•	•	•			•			•	•		•
Sterilization																			
Storage, general											•	•				•	•		
Storage, bulk corrosive																			
Storage, inflammable																			
Weighing	•			•	•	•	•	•	•	•	•		•			•	•		•
Writing (administrative)				•				•	•										
Writing (laboratory)	•	•	•	•	•	•	•	•	•				•	•		•	•	•	•
FINISHES																			
Walls	3	3	3	3	3	3	3	3	3	3	3	6	3	3	2	3	3	5	3
Ceilings	3	3	3	3	3	3	3	3	3	3	3	6	3	3	5	3	3	4	3
Floors	3	3	3	3	3	3	3	3	3	3	3	6	3	5	3	3	3	3	3
BUILDING CHARACTERISTICS																			
Airtightness																			
Radiation source							•												
Sound source	•		•	•	•		•	•	•				•			•	•		•
Sound insulation required																			
Vibration free	•		•	•		•		•	•					•		•			•
Black-out facility															•				
High security	•		•	•		•													

TABLE 3

Relates activities to Services, Ancillary equipment, Workbenches, machine stands and sinks, Storage

ACTIVITIES	Potable water	Hot water	Deionised water	Normal waste	Corrosive waste	Organic waste	Radioactive waste	Macerated waste	Drench shower	Fuel gas	Laboratory gases	Single-phase electricity supply	Three-phase electricity supply	Uninterrupted electricity supply	Clean electricity supply	Emergency electricity supply	Safety cut-out	Alarm systems	Call system	Computer service	Intercom	Radio	Remote dictation	Telephone	Television	Task lighting	Air pressure delivery tubes
Ablutions	•	•		•																							
Automated analysis/system	•		•	•	•	•	•				•	•	•	•		•	•			•				•			
Category 3 work	•	•	•		•							•	•				•							•		•	
Centrifugation												•	•				•										
Chemical disposal, bulk	•	•		•	•							•									•						
Chemical tests, manual	•		•	•	•	•			•			•					•			•	•			•		•	
Computing												•		•		•	•			•	•			•		•	
Equipment maintenance	•	•	•	•								•				•	•									•	
General laboratory work	•	•	•	•	•	•			•	•	•	•				•				•	•			•		•	
Media preparation	•	•	•	•						•		•	•				•			•				•		•	
Microscopy												•				•				•	•			•			
Overnight duty	•	•		•																•	•	•		•	•		
Packaging and posting, specimens	•	•		•								•								•	•			•			
Preparation of liquids	•		•		•							•					•				•			•		•	
Preparation of specimens																											
Radio-isotopes handling/disposal	•		•	•			•					•	•				•			•	•			•		•	
Slide preparation	•	•	•	•						•		•				•	•									•	
Solvent handling	•			•																						•	
Specimen cut-up (Histopathology)	•	•		•		•						•				•	•			•			•	•		•	
Specimen disposal	•	•		•		•		•				•					•			•	•			•		•	
Specimen reception	•	•		•								•				•	•			•	•			•		•	•
Staining	•		•	•	•							•														•	
Sterilization	•	•	•			•				•		•	•								•			•			
Storage, general																											
Storage, bulk corrosive									•																		
Storage, inflammable																											
Weighing																											
Writing (administrative)																				•	•		•	•			
Writing (laboratory)																				•	•			•	•		

TABLE 3 (contd)

Relates activities to Services, Ancillary equipment, Workbenches, machine stands and sinks, Storage

ACTIVITIES	Extract ventilation: general	Extract ventilation: local	Supply ventlation	Cooling	Refrigeration	Refrigeration malfunction alarm	Safety cabinet	Fume cupboard	Laminar flow cabinet	Ventilated bench	Adaptability	Wet work	Minor spillages	Regular spillages	Water	Corrosive chemicals	Non-corrosive chemicals	Organic spillage	Powder or solid spillage	Light staining	Heavy staining	Dry work	Occasional abrasion	Regular abrasion	Occasional cutting	Regular cutting	Heavy equipment
Ablutions																											
Automated analysis/system	•				•	•					•	•	•		•	•	•	•		•		•					•
Category 3 work	•						•					•	•			•	•	•				•					
Centrifugation												•	•									•					•
Chemical disposal, bulk	•							•				•		•	•	•	•		•		•	•					
Chemical tests, manual	•				•			•				•	•	•		•	•	•				•					
Computing																						•					
Equipment maintenance												•	•			•				•		•					
General laboratory work	•			•	•	•		•			•	•	•		•	•	•	•	•	•		•		•		•	•
Media preparation	•				•	•			•		•	•	•	•	•		•			•		•	•	•			•
Microscopy											•	•	•					•				•					
Overnight duty																											
Packaging and posting, specimens	•				•						•		•									•					
Preparation of liquids					•			•				•							•		•						
Preparation of specimens																											
Radio-isotopes handling/disposal	•					•	•		•		•	•	•									•					•
Slide preparation										•		•	•		•		•					•					
Solvent handling	•									•		•		•													
Specimen cut-up (Histopathology)	•									•		•		•	•			•				•		•		•	
Specimen disposal	•				•					•	•	•		•			•					•					
Specimen reception	•				•						•	•	•									•					
Staining	•				•							•		•		•	•	•		•							
Sterilization	•			•	•							•		•	•			•				•					•
Storage, general																											
Storage, bulk corrosive																											
Storage, inflammable																											
Weighing																•	•		•	•		•					
Writing (administrative)																						•					
Writing (laboratory)																						•					

TABLE 3 (contd)

Relates activities to Services, Ancillary equipment, Workbenches, machine stands and sinks, Storage

ACTIVITIES	Light equipment	Surface colour – light	Surface colour – dark	Workbench	Machine stand	Bench height 720	Bench height 920	Sink	Drip cup	Underbench storage	Mobile	Static	Overbench storage	Open	Closed	Bilk storage	Ventilated specimen storage	Gas/flammable storage
Ablutions																		
Automated analysis/system	•			•	•		•			•				•	•	•		•
Category 3 work				•	•	•	•	•	•				•	•	•			
Centrifugation	•			•	•	•	•			•								
Chemical disposal, bulk			•	•			•	•		•			•			•	•	
Chemical tests, manual	•	•		•			•	•	•	•	•	•	•	•	•	•		
Computing	•			•						•	•			•	•			
Equipment maintenance				•					•	•			•					
General laboratory work	•	•		•	•		•	•	•	•	•	•	•	•	•	•		
Media preparation	•			•			•	•	•	•	•	•	•	•	•	•		
Microscopy	•	•				•	•	•					•					
Overnight duty																		
Packaging and posting, specimens	•			•		•	•	•					•	•				
Preparation of liquids				•						•			•			•		
Preparation of specimens																		
Radio-isotopes handling/disposal		•		•	•		•	•	•	•			•					
Slide preparation		•		•						•			•					
Solvent handling				•						•			•					
Specimen cut-up (Histopathology)	•	•		•			•	•					•					
Specimen disposal				•			•	•	•	•			•					
Specimen reception	•	•		•		•	•	•		•		•		•		•		
Staining	•		•	•			•	•	•	•	•	•	•					
Sterilization	•			•	•		•	•	•	•		•		•		•		
Storage, general														•	•	•	•	
Storage, bulk corrosive																•		
Storage, inflammable																		•
Weighing	•			•			•						•					
Writing (administrative)				•			•						•					
Writing (laboratory)				•		•							•					

6 Engineering services

6.1 BS EN 14056:2003 and HBN 15 – 'Facilities for pathology services' give general guidance on services in laboratories. All current legislation and safety aspects should be complied with. Particular attention should be paid to potentially dangerous combinations of services. Cavities containing certain gases will require ventilation.

6.2 A wide range of engineering services will need to be accommodated in ceiling voids, horizontal ducts or runs above or below work surfaces, vertical ducts from benches to ceiling voids, and in partitions.

DRAINAGE

6.3 Drainage systems will be required to deal with a range of chemical or organic waste, some requiring special attention to the design of the drainage system, involving limited lengths of wastes, and special traps, particularly where macerators are used. Wastes to bench sinks should be formed of corrosion- and acid-resisting pipework discharging into floor or wall outlets.

6.4 Where benches are loose or intended for regular rearrangement, wastes can be of smooth-bore flexible pipework.

6.5 Drench showers (and possibly eye-bath facilities; a COSHH assessment should be carried out first to ascertain what hazards are present before taking a decision) will be needed in areas where hazardous substances present a danger. Suitable floor gratings are included in HTM 64 – 'Sanitary assemblies'.

PIPED OR WIRED SERVICES

6.6 Other piped services may also be in flexible pipework when used in adaptable bench arrangements. Flexible gas connections will require automatic cut-off valves.

6.7 Taps to serve sinks and drip-cups should normally be mounted horizontally on walls or ducts, or drop vertically from the underside of horizontal over-bench ducts. This is to ensure easily cleaned, hygienic junctions with mounting surfaces. In some cases, such as when benches or sinks adjoin windows, deck mounting may be unavoidable. Where hoses are attached to taps, or where venturi pumps are to be used, suitable protection from back-siphonage must be provided (The Water Supply (Water Fittings) Regulations 1999).

6.8 Isolation switchgear for emergency use should be sited conveniently for users, especially on peninsular or island benches.

VENTILATION

6.9 Because of the variety of fumes and gases that are likely to be present, specialised local exhaust ventilation (LEV) systems will be required to comply with the Control of Substances Hazardous to Health Regulations 2002. Where both general laboratory ventilation and LEV systems are installed, specialist advice should be sought to ensure that they do not adversely interact with each other.

6.10 Building features which can affect the aerodynamic performance of equipment with extract capability are opening windows, doors, beams, columns, the mechanical ventilation system, and peculiar wind changes caused by adjacent buildings. Large pieces of equipment and passing traffic can also have a detrimental effect.

7 Building components and finishes

7.1 The design, construction, materials, building components and finishes are extremely important to the efficient operation of laboratories.

7.2 The other volumes in the building component series of HTMs 54–71 give general guidance on components and finishes.

7.3 In some cases the partitions, floors and ceilings may need to enclose spaces within a laboratory sufficiently well to prevent the passage of gases or biological material, smoke and fire.

7.4 The layout of the building and fire requirements may determine that some of these elements should be of fire-resisting construction.

7.5 The detailing of joinery and finishes should be designed to prevent the accumulation of dirt, particularly to horizontal surfaces.

7.6 Where radioactive substances are used, precautions may be necessary in the designing and detailing of doors, walls, ceilings and floors. Some form of tanking/containment may be necessary to stop the migration of radioactive fluids.

7.7 Refer to the sections dealing with worktops and drainage.

PARTITIONS

7.8 HTM 56 – 'Partitions' gives general guidance on partitions and wall finishes for health buildings.

7.9 The partitions forming the rooms and spaces of pathology departments may be of permanent construction or of a type easily moved to permit rearrangement of laboratory areas. They may be masonry or hollow-framed construction. They should be robust enough to withstand impact from trolleys, equipment and people. The construction and finishes should be durable and easily cleaned. They should be capable of supporting fittings and services. They will require a degree of imperviousness.

7.10 Sound insulation may be required for some rooms.

CEILINGS

7.11 HTM 60 – 'Ceilings' gives general guidance.

7.12 Ceilings frequently include lighting and service outlets, and an easily cleaned surface is essential.

FLOORING

7.13 HTM 61 – 'Flooring' gives general guidance.

7.14 The structure of floors should be rigid enough to reduce the incidence of deflection and cracking to a minimum to prevent the passage and lodgement of biological and chemical material.

7.15 The surface finishes should be impervious, easily cleaned, durable, comfortable and reasonably slip-resistant.

7.16 Block and section cutting in pathology laboratories presents problems with wax pouring and cutting. Recent trials have shown that textile floor coverings of a short pile with low retention characteristics can be effective in combating this problem.

7.17 Steps at split levels such as at entrances must be avoided to take account of the special needs of disabled people (see Approved Document M, Building Regulations) and where corrosive liquids could be transported.

WALL, CEILING AND FLOOR FINISHES

7.18 These are shown in Table 2.

DOORS

7.19 HTM 58 – 'Internal doorsets' gives detailed guidance including widths of openings.

7.20 Doors should permit easy access for people, goods, trolleys and the largest items of equipment during building, the commissioning period and the life of the building. A number of double doors will be required. The requirements of disabled staff and patients must be considered, particularly in venesection areas: HBN 40 – 'Common activity spaces' gives guidance.

7.21 Finishes should be suitable for the use of the room. Applied protection or damage-resistant finishes will be required on some doors.

7.22 Vision panels are required to most doors to reduce the risk of collisions, especially where vessels containing dangerous chemicals are being transported.

IRONMONGERY

7.23 Ironmongery should be chosen carefully. Unnecessary latches and handles should be avoided in favour of push plates and pull handles with closers, leaving hands free (see HTM 59 – 'Ironmongery').

7.24 Security is essential and requires careful consideration. External access control into laboratory buildings or departments must be monitored; generally, digital or electronic systems are installed. Locks on doors are usually suited. Central locking systems may be appropriate. Agreement with management must be obtained, and specialist advice is recommended.

SANITARY ASSEMBLIES

7.25 Appliances should be easily cleaned and equipped with fittings which can be operated without the use of hands. HTM 64 – 'Sanitary assemblies' gives advice on this and includes "hospital pattern" fittings which are suitable.

7.26 Drench showers and eyewash facilities will be required in certain areas.

WINDOWS

7.27 Windows are extremely important in providing daylight, but ventilation is better achieved by mechanical means because uncontrolled draughts can seriously interfere with the operation of fitments with extract capability (see HTM 55 – 'Windows').

7.28 Care should be taken to ensure that windows are positioned to give good daylighting to the full depth of the room (this means high window heads). Sills should be at an appropriate height, and proper regard should be paid to the problem of glare and the prevention of solar gain.

7.29 Service runs, radiators and benches must be taken into account when determining sill heights.

ALARM SYSTEMS

7.30 Alarm systems may include hazard alarms, intruder systems, closed-circuit television, smoke detectors and fire alarms.

7.31 Security alarm systems are very important and require careful consideration in the design and fitting out of laboratories (see HBN 15 – 'Facilities for pathology services').

8 Procurement: manufacturers' proprietary ranges

8.1 Where a manufacturer offers a complete range of the components described in this HTM made to its own design, the architect should require that test certificates be produced showing compliance with the requirements of this HTM together with a detailed product specification.

8.2 The use of this method of procurement could result in incompatibility of units if more than one manufacturer is used.

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Castor Manufacturers Association/Furniture Industry Research Association

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