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Health Technical Memorandum 03-01 Specialised ventilation for healthcare premises
Part B: The management, operation, maintenance and routine testing of existing healthcare ventilation systems

Preface

This HTM was prepared prior to the COVID-19 pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It has been reviewed against the known transmission evidence available at the time of publication. Ventilation is one of many mitigations against the virus and should be part of a package of infection prevention and control measures. The ventilation rates recommended in this document are likely to provide a lower risk environment for COVID-19 airborne transmission. Emerging evidence will continue to be reviewed as and when available.

About Health Technical Memoranda

Health Technical Memoranda (HTMs) give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare.

The focus of Health Technical Memorandum guidance remains on healthcare-specific elements of standards, policies and up-to-date established best practice. They are applicable to new and existing sites, and are for use at various stages during the whole building lifecycle.

Language usage in technical guidance

In HTMs and HBNs, modal verbs such as "must", "should" and "may" are used to convey notions of obligation, recommendation or permission. The choice of modal verb will reflect the level of obligation needed to be compliant.

The following describes the implications and use of these modal verbs in HTMs/HBNs (readers should note that these meanings may differ from those of industry standards and legal documents):

- "Must" is used when indicating compliance with the law.
- "Should" is used to indicate a recommendation (not mandatory/ obligatory), i.e. among several possibilities or methods, one is recommended as being particularly suitable – without excluding other possibilities or methods.
- "May" is used for permission, i.e. to indicate a course of action permissible within the limits of the HBN or HTM.

Typical usage examples

- "All publicly-funded organisations must ensure that all contracts established to collect and treat waste conform to the Public Contracts Regulations." [obligation]

This guidance is not mandatory (unless specifically stated). However, any departures/ derogations from this HTM – including the measures implemented – should provide a degree of safety not less than that achieved by following the guidance set out in this HTM.

- "All low voltage (LV) distributions should be configured as TN systems." [recommendation]
- "Alcohol hand gels that do not contain siloxanes may be rinsed out and the packaging recycled or placed into the municipal waste stream." [permission]

"Shall", in the obligatory sense of the word, is never used in current HTMs/HBNs.

Project derogations from the Technical Guidance

Healthcare facilities built for the NHS are expected to support the provision of high-quality healthcare and ensure the NHS Constitution right to a clean, safe and secure environment. It is therefore critical that they are designed and constructed to the highest and most appropriate technical standards and guidance. This applies when organisations, providers or commissioners invest in healthcare accommodation (irrespective of status, for example Foundation and non-Foundation trusts).

Statutory standards plus technical standards and guidance specific to NHS facilities:

Health Building Notes

Health Technical Memoranda

Complete list of NHS estates-related guidance

The need to demonstrate a robust process for agreeing any derogation from Technical Guidance is a core component of the business case assurance process.

The starting point for all NHS healthcare projects at Project Initiation Document (PID) and/or Strategic Outline Case (SOC) stage is one of full compliance.

Derogations to standards will potentially jeopardise business case approval and will only be considered in exceptional circumstances. A schedule of derogations will be required for any project requiring external business case approval and may be requested for those that have gone through an internal approvals process.

While it is recognised that derogation is required in some cases, this must be risk-assessed and documented in order that it may be considered within the appraisal and approval process.

Derogations must be properly authorised by the project's senior responsible owner and informed and supported by appropriate technical advice (irrespective of a project's internal or external approval processes).

Sustainability and 'Net Zero Carbon' targets

Healthcare provision is a significant contributor to the UK's carbon footprint. (In 2019, this was estimated to be around 5.4% of our greenhouse gases.) Accordingly, all NHS organisations have their part to play in meeting Net Zero Carbon targets alongside other sustainability measures.

In January 2020, Health chief Sir Simon Stevens announced three steps the NHS will take during 2020 to tackle this problem:

- NHS England has established an expert panel to chart a practical route map to enable the NHS to get to 'net zero'. The panel will submit an interim report to NHS England in summer 2020 and a final report ahead of the November 2020 UN Climate Change Conference (COP26) in Glasgow. The panel will consider changes the NHS can make in its own activities; in its supply chain; and through wider partnerships;
- the NHS Long Term Plan commits to better use of technologies to make up

to 30 million out-patient appointments redundant, sparing patients thousands of unnecessary trips to and from hospital. It is estimated that 6.7 billion road miles each year are from patients and their visitors travelling to the NHS;

- the panel will consider changes that can be made in the NHS's medical devices, consumables and pharmaceutical supply, and areas the NHS can influence such as the energy sector as the health service moves to using more renewable energy.

For specific ventilation-related measures, see the "Net Zero Carbon" section on page vi.

Executive summary

Preamble

Health Technical Memorandum 03-01 – 'Specialised ventilation in healthcare premises' is published in two parts:

Part A: The concept, design, specification, installation and acceptance testing of healthcare ventilation systems.

Part B: The management, operation, maintenance and routine testing of existing healthcare ventilation systems.

The documents give comprehensive advice and guidance on the legal requirements, design implications, maintenance and operation of specialised ventilation in healthcare premises providing acute care. The use of these premises is very intense, the occupancy level high and the patients may be particularly susceptible to airborne infection risks. Their condition may also require close control of the environment.

The ventilation of non-healthcare facilities within the hospital curtilage should be designed to suit the application and specific guidance relating to the activity should be followed, for example pharmacy, sterile services department, etc. However, as they are on the hospital site, the means of providing ventilation should not adversely impact upon the hospital (for example, evaporative cooling towers should not be installed, sound levels should be appropriate and if the facility is within or attached to an area accessed by patients, their needs and the risk of airborne contamination should be considered).

In other types of healthcare facility that are outside of the hospital curtilage, for example GP practices, health centres, minor injuries units, dental, ophthalmic and podiatry clinics, mental health facilities, respite and long stay care homes and hospices, etc, a risk assessment of the nature of the treatment being delivered, condition of the patients and intensity of use needs to be undertaken by those responsible for the facility in order to determine the extent to which this guidance will be applicable.

The guidance contained in Part A of this Health Technical Memorandum applies to new installations and major refurbishments of existing installations and should be considered as the standard to be achieved.

The guidance contained in Part B of this Health Technical Memorandum applies to all ventilation systems installed in healthcare premises irrespective of the age of the installation and should be considered as the standard to be achieved.

Health Technical Memorandum 03-01 (2021) supersedes all previous versions of Health Technical Memorandum 03-01 – 'Specialised ventilation in healthcare premises' (2007). It also supersedes HTM 2025 (1994) and DV4 (1983).

Who should use this guidance?

This document is aimed at specifiers, designers, suppliers, installers, estates and facilities managers and operations. Elements of the document will also be relevant to managers concerned with the day-to-day management of healthcare facilities and senior healthcare management.

Main changes since the 2007 edition

- Design information for specific healthcare applications has been revised and information on the reason for ventilation given. For example, endoscopy rooms are now negative pressure to contain and remove odours and manage airborne risks to staff. These endoscopy-specific risks (i.e. waste anaesthetic gases and pathogenic material (for example, multi-drug-resistant tuberculosis) discharged by the patient during the procedure being undertaken) were identified prior to the SARS-CoV-2 pandemic. As with other elements in Part A, the application of this change is not retrospective but applies to new installations and major refurbishments (see Preamble above).
- The client's needs and legal requirements are more clearly explained.
- This edition of Health Technical Memorandum 03-01 introduces the concept of the Ventilation Safety Group in healthcare organisations (similar to the Water Safety Group in Health Technical Memorandum 04-01 and the Electrical Safety Group in Health Technical Memorandum 06-01). This is a multidisciplinary group whose remit will be to assess all aspects of ventilation safety and resilience required for the safe development and operation of healthcare premises.
- The HTM introduces a standard method of identifying and labelling ventilation systems and the creation of an inventory of installed systems.
- The issues of resilience and diversity are addressed.
- Guidance is provided on refurbishments or when changing the use of an existing installation.
- Guidance is given on lifecycle and the updating of mid-life plant.
- Design information for specific healthcare application has been extensively revised.
- Issues around rooms where anaesthetic agents are used are addressed.
- Airflow rates are more tailored to the applications to take advantage of new fan and control technology and so reduce energy consumption.
- Revised air quality and filter standards are given.
- New and emerging technologies are catered for.
- Advice is given on installation standards and the appointment of an independent validator.
- More detailed information is given on the commissioning process.
- Validation acceptance standards and methodology has been completely revised.
- Routine inspection and maintenance guidance has been revised and updated.

Net zero carbon

Health Technical Memorandum 03-01 supports UK legislation to bring all greenhouse gas emissions to net zero by 2050, and promotes sustainable methods of ventilation in healthcare facilities. The

HTM's core principle is that the default method of ventilation should as far as possible be natural ventilation followed by mixed mode (natural with mechanical ventilation), with mechanical ventilation being the last option.

The energy consumption of ventilation systems should be further minimised by specifying solutions with the lowest lifecycle environmental cost. The basic objective of energy-saving strategies in this HTM is to provide the required ventilation service using the minimum energy. To this end, Health Technical Memorandum 03-01 recommends switching a system "off" when not required to be the most energy-efficient policy. If the system is needed to maintain a minimum background condition, reducing its output by "setting back" to the minimum necessary to achieve and maintain the desired condition is the next best option.

Fans represent an enormous potential for energy savings to reduce carbon emissions, as they are among the largest single users of energy (they use approximately 40% of all electricity in ventilation systems). The European Regulation 1253/2014, implementing the Energy-related Products (ErP) Directive, has significantly reduced the power to drive fans. Accordingly, Health Technical Memorandum 03-01 recommends using electronically commutated fans, as these have been proven to be the most energy-efficient, while also advising that belt-driven fans should no longer be installed.

There have been many legislative changes aimed at reducing energy consumption and technical advances that have increased operational efficiency. This revised HTM incorporates those changes and has amended many of the design parameters for healthcare ventilation. Designs that are simply repeated from previous installations designed to superseded standards and guidance will not meet the revised energy or operational standards and will not produce a compliant result.

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Contents

1.0 Introduction

Preamble

1.1 Health Technical Memorandum 03-01 – 'Specialised ventilation in healthcare premises' is published in two parts: Part A deals with the concept, design, specification, installation and acceptance testing of ventilation systems; Part B covers the management, operation, maintenance and routine testing of existing healthcare ventilation systems.

1.2 The document gives advice and guidance to healthcare management, design engineers, estates managers and operations managers on the legal requirements, design implications, maintenance and operation of specialised ventilation in all types of healthcare premises.

1.3 The guidance contained in Part B of this Health Technical Memorandum applies to all ventilation systems installed in healthcare premises irrespective of the age of the installation.

1.4 This revision of Health Technical Memorandum 03-01 supersedes the 2007 version of Health Technical Memorandum 03-01.

Ventilation in healthcare premises

1.5 Ventilation is used extensively in all types of healthcare premises to provide a safe and comfortable environment for patients and staff. It is provided to help control airborne infection risks in areas such as operating departments, critical care facilities, isolation rooms and treatment areas.

1.6 It may also be installed:

- to maintain a suitable environment by removing odours and controlling temperature;
- to ensure compliance with the quality assurance requirements of items processed in pharmacies and sterile services departments;
- to protect staff from harmful organisms or toxic substances, for example in laboratories and anaesthetic rooms;
- to contain the spread, and clear smoke as part of the fire strategy.

Statutory requirements

The Health Act 2009

1.7 The Health Act places a duty of care on healthcare providers. Increased health risks to patients will occur if ventilation systems do not achieve and maintain the required standards. The link between surgical site infection and theatre air quality has been well established. If the ventilation plant has been installed to dilute or contain harmful substances, its failure may expose people to unacceptable levels of contamination. Breaches of the statutory requirements can

result in prosecution and may also give rise to a civil suit against the operators.

Health and Safety at Work etc. Act 1974

1.8 The Health and Safety at Work etc. Act 1974 is the core legislation that applies to ventilation installations. As these installations are intended to prevent contamination, closely control the environment, dilute contaminants or contain hazards, their very presence indicates that potential risks to health have been identified.

COSHH

1.9 The Control of Substances Hazardous to Health (COSHH) Regulations 2002 (as amended) place upon management an obligation to ensure that suitable measures are in place to protect their staff and others affected by the work activity. These methods may include both safe systems of work and the provision of a specialised ventilation system. In laboratories the requirements are often met by the provision of fume cupboards and microbiological safety cabinets.

1.10 Where specialised ventilation plant is provided as part of the protection measures, there is a statutory requirement that it be correctly designed, installed, commissioned, operated and maintained. The local exhaust ventilation (LEV) section of COSHH requires that the system be examined and tested at least every 14 months by a competent person (P601 certified) and that management maintain comprehensive records of its performance, repair and maintenance.

1.11 Certain substances have workplace exposure limits (WELs) set out in the Health and Safety Executive's Guidance Note EH40 – 'Workplace exposure limits' contains the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended). If specialised ventilation systems are provided in order to achieve these standards, they will be subject to the COSHH Regulations as above.

Workplace (Health, Safety and Welfare) Regulations

1.12 These state that all enclosed workplaces must be ventilated by natural or artificial means.

1.13 Any plant provided under this legislation shall include an effective device to give an audible or visual warning of plant failure where necessary for health and safety.

1.14 The Regulations require that ventilation systems are "maintained in an efficient state, in efficient working order and in good repair".

Building Regulations

1.15 These apply to domestic and non-domestic buildings.

1.16 They clarify satisfactory methods of providing ventilation and give ventilation rates.

1.17 They set minimum standards for:

- the protection of the supply position;
- precautions against *Legionella*;
- the purity of recirculated air;
- access for service and maintenance;
- documentation and proof of performance.

Fire regulations

1.18 The fire regulations require that, if ventilation ductwork penetrates the fabric of a building, it should be designed and installed to contain the spread of fire and

smoke (see the Health Technical Memorandum 05 series for guidance).

1.19 When a ventilation system was originally designed, it will have conformed to an agreed fire strategy. This will have determined the provision of fire-rated ductwork, the siting of fire and smoke dampers and an agreed control action for the ventilation fans in the event of a fire.

1.20 It is management's responsibility to ensure that the fire strategy applied during the design and installation of a system is not reduced during the subsequent operation and maintenance of the equipment.

1.21 If a ventilation system is upgraded or altered to suit a change of use, it will be necessary to reassess the fire strategy.

Plant installed for units manufacturing medicinal products

1.22 Plant installed for units manufacturing medicinal products to the standards set out in the current European guide to good manufacturing practice may also be subject to particular legislation with regard to their operation in addition to that mentioned above.

1.23 There are specific requirements under the Medicines Act 1968 to maintain accurate records of plant performance, room conditions and maintenance events. Such records would need to be preserved for at least 25 years as part of a quality assurance audit trail.

Plant installed for laboratories

1.24 Specialised ventilation plant installed for laboratories dealing with research, development, testing or other specialist applications (this could concern medicinal products, IVF, tissue, animals or genetically modified organisms) may be subject to particular legislation with regard to their operation in addition to that mentioned above.

Codes of practice and guidance

1.25 All ventilation systems should conform to the principles set out in the Health and Safety Executive's (HSE) Approved Code of Practice and guidance on regulations – 'Legionnaires' disease: the control of *Legionella* bacteria in water systems' (commonly known as L8), and Health Technical Memorandum 04-01 – 'Safe water in healthcare premises'.

1.26 The HSE has published complementary technical guidance in HSG274, which is split into three specific areas:

- Part 1 – evaporative cooling systems
- Part 2 – hot and cold water systems
- Part 3 – other risk systems.

1.27 The Department of Health publication 'The Health and Social Care Act (2013) Code of Practice on the prevention and control of infections and related guidance' (the HCAI Code of Practice) is a code of practice that helps NHS bodies to plan and implement how they can prevent and control healthcare-associated infections. It sets out criteria by which managers of NHS organisations are to ensure that patients will be cared for in a clean environment and where the risk of healthcare-associated infections is kept as low as possible. Specialised ventilation systems often play a significant role in achieving this objective.

Management responsibilities – general

1.28 It is a management responsibility to ensure that inspection, service and maintenance activities are carried out safely without hazard to staff, patients or members of the public.

1.29 Those required to monitor and/or maintain ventilation equipment will need to show that they are competent to do so (see Chapter 2).

1.30 Maintenance procedures should be reviewed periodically to ensure that they remain appropriate.

1.31 The preservation of information and records of ventilation systems and their performance is a legal requirement. It is therefore essential that records are kept in a form that when archived can be accessed when necessary. Keeping records on a dedicated computer drive unit within the estates department, while satisfactory for day-to-day operation, is not adequate for archival storage.

1.32 Estates statutory maintenance records will be retained and managed through the healthcare provider's information governance arrangements. Estates departments should periodically archive their records of statutory and critical systems.

System information

1.33 An inventory of all ventilation systems installed and in use or capable of being used will need to be kept. The inventory should be readily accessible within the operational section of the estates department in hard copy and electronic form.

1.34 The inventory should be subdivided into the following categories:

- Local exhaust ventilation systems - (LEV) – note these are statutory items.
- Critical healthcare ventilation systems – (CHV). (These are systems the loss of which would seriously limit the delivery of healthcare, for example operating suite, NICU, critical care area, interventional imaging suite, aseptic suite.)
- General ventilation system [supply and extract] (GVS).
- General extract systems (GES).
- Systems installed for smoke clearance in the event of a fire, classed as smoke and heat exhaust ventilation systems (SHEVS) (for example, smoke extract fans in stairwells, automatic smoke clearance dampers in atria).

1.35 For each ventilation system the inventory should contain the following details:

- A unique system identification code for example LEV 001; CHV 001 etc as appropriate.
- The location of the ventilation fan unit or supply and extract air-handling unit(s) (AHU(s)).
- The location of the fresh air inlet.
- The location of the extracted air discharge.
- The specific area(s) served by the system.
- The date the system was installed.
- The date the system was first commissioned.
- The date of its annual inspection.
- The date and details of any significant alterations or replacements made to the system.

1.36 When systems are removed or replaced, their unique identification code should be transferred from the inventory to an archive together with all its records. These should be retained for a minimum of five years (25 years for a manufacturing pharmacy) (see paragraphs 1.31 and 1.32).

1.37 New or replacement systems should be allocated a new unique identification and added to the inventory.

1.38 Each ventilation system should have a log (physical or electronic) that contains the following information:

- The unique system identification reference.
- Purpose of the system.
- Date of installation.
- Details of the installed equipment and ductwork layout.
- Detail of the fire plan, any fire-rated ductwork and location of fire and smoke dampers.
- Design performance parameters, for example airflow rates, air-change rates, pressures, etc.
- Commissioned date and performance.
- Record of the system validation and original acceptance.
- Records of the annual inspection and verification.
- Maintenance records and plant information, for example fan specifications and filter sizes.

1.39 The records should be linked to the inventory and stored in such a way as to be readily available in the event of plant breakdown or other incident.

1.40 When new ventilation systems are accepted for use, full information as to their designed mode of operation together with recommended maintenance procedures should be provided as part of the handover procedure (Building Regulations 2010 Part 8 Para 39). Part A of this Health Technical Memorandum gives design parameters for new installations and lists the handover information required.

1.41 Many new installations are designed and stored electronically within a building information modelling (BIM) program. It is important to update the BIM model if there are any physical changes made or design parameters modified during the life of the system.

1.42 In existing systems, original design and commissioning information will often not be available. It will be necessary to determine a suitable level of system performance based on the function, purpose and age of the installation. This information should be entered in the system log file and form the baseline for the annual verification.

1.43 Chapter 3 of this document sets out the minimum standards for all air handling units (AHUs) and their air distribution systems irrespective of when they were installed.

Note:

The minimum standards were first set out in Health Technical Memorandum 2025, 1994.

1.44 All system records must be kept for at least five years (25 years for a manufacturing pharmacy). The Health and Safety Executive and other interested bodies such as the Care Quality Commission (CQC) have a statutory right to inspect them at any time (see paragraph 1.31).

Action in the event of an incident

1.45 In the event of a reportable incident connected with ventilation equipment or the area that it serves, copies of all records and plant logbooks may need to be collected as evidence. The requirements of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) will apply.

Note:

In the event of an incident, while there may be a legal requirement to hand over information and records to the investigator, it is essential that the healthcare provider retains copies as they will be necessary for the continued safe operation and maintenance of the system, which is a legal requirement.

Frequency of inspections and verifications

1.46 In order to comply with the Workplace (Health, Safety & Welfare) Regulations and Building Regulations, it is essential that all ventilation systems must be subject to at least a simple visual inspection annually.

1.47 In order to comply with the provisions of the Health Act, all CHVs should be inspected quarterly and their performance measured and verified annually. The quarterly inspection should be a simple visual check; the annual verification will be a more detailed inspection of the system together with the measurement of its actual performance.

1.48 Chapter 4 sets out the annual inspection and verification requirements and a supporting set of specimen checklists is given in the Appendices. Equipment manufacturers and suppliers may also recommend specific maintenance inspections.

1.49 The LEV section of the COSHH regulations contains a statutory requirement that systems installed to contain or control hazardous substances be examined and tested at least every 14 months by a competent person (P601 certificated). The statutory inspection and test must be of the complete system from the point of capture to the point of discharge.

1.50 Regular tests, at intervals agreed with the local fire prevention officer, will need to be carried out in order to demonstrate the continuing efficiency of the fire detection and containment systems. These may be in addition to the inspections detailed above. Records of these tests must be kept.

Lifecycle of ventilation systems

1.51 Plant should be scheduled for replacement after 20 years. CIBSE Guide M gives advice on plant lifecycle and the risk assessment of plant condition. In order to secure funding and programme downtime for the area served, a site-wide plant replacement programme should be in place. As an example, if a site has 40 AHUs then at least two will need to be replaced every year. The plant replacement should coincide with a refurbishment of the area served.

Note:

If the site was a new build with all plant of the same age, then assessment of the replacement programme should commence after 10 years as it will not be practical to replace all units simultaneously at the 20-year mark.

1.52 The Ventilation Safety Group (VSG) (see Chapter 2) will prioritise the replacement programme. Failure to plan for plant replacement has led to unplanned system failures with a consequent loss of the facility that they serve and cancellation or disruption to patient services.

1.53 In order to maintain efficiency, ventilation systems should be refurbished at their mid-life point (typically 10 years after original installation). The complete system should be taken out of use and thoroughly inspected. The AHU and its distribution ductwork should be cleaned as appropriate, any internal corrosion investigated and treated, the complete control system up-

graded and the entire installation rebalanced and recommissioned. The performance of the system should be validated (see Chapter 12 in Part A of this Health Technical Memorandum) before being returned to service.

Note:

During this process the opportunity should be taken to replace any belt-driven fans with the most energy-efficient fans available, for example electronically commutated (EC) plug fans or direct-drive plug fans. (Chapter 9 in Part A of this Health Technical Memorandum gives details of fan types and preferred selection and installation strategies.)

1.54 Whenever an area of the healthcare estate is being refurbished, the condition and energy performance of its ventilation plant should be reviewed. The plant should be upgraded, refurbished or replaced as appropriate in order to take advantage of the most energy-efficient equipment and control methods available at the time.

2.0 Functional responsibilities

Management responsibilities

2.1 Clear lines of managerial responsibility should be in place so that no doubt exists as to who is responsible for the safe operation and maintenance of the equipment.

2.2 A periodic review of management systems should take place in order to ensure that the agreed standards are being maintained.

2.3 Those required to inspect, verify or maintain ventilation equipment will need to show that they are competent to do so. As a minimum they should have sufficient knowledge of its correct operation to be able to recognise faults.

2.4 Training in the validation and verification of specialised healthcare ventilation systems for Authorised Persons (APs) and Competent Persons (CPs) is available from a variety of providers. While there is a duty on post holders to keep their knowledge up to date, as reflected for APs in their CPD record, there is no requirement to routinely attend any specific refresher course.

Designated staff functions

2.5 A person intending to fulfil any of the staff functions specified below should be able to prove that they possess sufficient skills, knowledge and experience to be able to safely perform the designated tasks (see Chapter 3 in Health Technical Memorandum 00 for more detailed information).

Management (Duty Holder)

2.6 Management is defined as the owner, occupier, employer, general manager, chief executive or other person who is ultimately accountable for the safe operation of premises.

Designated Person

2.7 This person provides the essential senior management link between the organisation and professional support. The Designated Person should also provide an informed position at board level and confirm the appointment of the following staff in writing.

Authorising Engineer (Ventilation) (AE(V))

2.8 The AE(V) is defined as a person designated by Management to provide independent auditing and advice on ventilation systems, to review documentation on verification and validation and witness the process as necessary.

Note:

Authorising Engineers should be able to show that they are free to provide independent advice and have been subject to an assessment of their competence by a registration body.

Authorised Person (Ventilation) (AP(V))

2.9 The AP(V) will be an individual possessing adequate technical knowledge and having received appropriate training, appointed in writing by the Designated Person (in conjunction with the advice provided by the AE(V)), who is responsible for the practical implementation and operation of Management's safety policy and procedures relating to the engineering aspects of ventilation systems.

Competent Person (Ventilation) (CP(V))

2.10 The CP(V) is defined as a person designated by Management to carry out maintenance and periodic testing of ventilation systems.

Infection Prevention and Control Person

2.11 The Infection Prevention and Control Doctor or consultant microbiologist is the person nominated by management to advise on monitoring the infection control policy and microbiological performance of the systems.

User

2.12 The User is the person responsible for the management of the unit in which the ventilation system is installed (for example head of department, operating theatre manager, laboratory manager, production pharmacist, head of research or other responsible person).

Contractor

2.13 The Contractor is the person or organisation responsible for the supply of the ventilation equipment, its installation, commissioning, validation, verification or decommissioning. This person may be a representative of a specialist ventilation organisation or a member of the general manager/chief executive's staff.

Appointment of post holders

2.14 All post holders should be appointed in writing by the "Designated Person" (see paragraph 2.7). A record should be kept of those appointed to carry out the functions listed above. The record should clearly state the extent of the post holder's duties and responsibilities, and to whom they are to report.

2.15 Substitute or replacement staff should be designated in order to cover for sickness, holidays and staff transfers.

Ventilation Safety Group (VSG)

2.16 The management of the ventilation systems of a healthcare provider should be overseen by the Ventilation Safety Group (VSG). The VSG should have clearly defined roles and responsibilities, be part of a healthcare organisation's governance structure and report to the designated person at Board level. It will be led and chaired by a person who has appropriate management responsibility, knowledge, competence and experience (for example the Designated Person).

2.17 The VSG should be a multidisciplinary group and will typically comprise:

- an AE(V)/independent adviser for ventilation;

- an Infection Prevention and Control Person (as defined above);
- the AP(V);
- estates (operations and projects) staff;
- clinicians and specialist departments (for example theatres, critical care, pharmacy, medical microbiology, nursing);
- personnel from the finance department with accountability for capital and revenue evaluation;
- other stakeholders as appropriate;
- co-opted expertise, for example ventilation designers, consultants and suppliers.

2.18 The VSG remit will be to assess all aspects of ventilation safety and resilience required for the safe development and operation of healthcare premises. It should inform the following areas:

- the design process for new healthcare premises;
- the design process for modifications to existing premises;
- the commissioning and validation process;
- operational management and maintenance;
- annual verification and performance testing;
- prioritising the plant replacement programme;
- decommissioning and removal of redundant equipment.

Note:

Where estates-and-facilities provider services are part of a contract (including PFI), it is essential that these providers participate fully in all those aspects of estates-and-facilities management that can affect patients. This includes responding to specific requests from the VSG, which may be in addition to relevant guidance and documentation.

2.19 It is important that decisions affecting the resilience, safety and integrity of the ventilation systems and associated equipment are not taken without the agreement of the VSG. The VSG should ensure that appropriate expertise and competence is available when making such decisions. Whenever significant building work is undertaken, the VSG should consider its effects on the existing ventilation system air intakes. These may need to be protected from airborne dust during construction by the fitting of temporary additional filtration. There will also be a need to identify any risks to construction personnel working in the vicinity of extract air discharges.

2.20 When building work is undertaken inside a building, the VSG should be consulted to determine its effects on the occupants. The VSG may need to specify the extent to which the area is to be sealed off from the operational parts of the building and the need for a temporary extract unit in order to maintain the worksite at a negative pressure to prevent the spread of contaminants into the rest of the building.

2.21 The healthcare provider, through its VSG, will be able to demonstrate that they have suitable governance, competence and accountability arrangements in place to provide safe critical ventilation systems and appropriate clinical environments in their premises.

Ventilation policy document

2.22 The VSG will produce a ventilation policy document for the healthcare provider. In its simplest form this may just

be a statement that the healthcare provider will follow the guidance contained in Health Technical Memorandum 03-01 Parts A and B as appropriate. It may also specify any departures from that guidance in terms of local additional requirements or derogations.

2.23 The policy document will be endorsed by the healthcare provider's board.

Risk Assessment – routine inspection and maintenance

2.24 Routine inspection and maintenance procedures can cause risks to the health of staff carrying out the work and those receiving air from the plant. All those involved should be made aware of the risks; safe systems of work should be agreed and followed. Suitable safety equipment should be provided as necessary, and training in its use should be given. Records should be kept for five years (see paragraph 1.31).

2.25 Training in the use of safety equipment and a safe system of work will need to be given and should be recorded, together with the date of delivery and topics covered. Any training may need to be repeated periodically in order to cater for knowledge refreshment and changes in staff.

Specific health and safety aspects

2.26 Staff engaged in the service and maintenance of extract ventilation systems from pathology departments, mortuaries, laboratories, isolation facilities and other areas containing a chemical, biological or radiation hazard may be particularly at risk. In these cases the risk should be identified and assessed.

2.27 The VSG should be consulted as to the means by which the system can be rendered safe to work on and a permit-to-work system implemented. Appendix 3 gives an example of a typical equipment release certificate (ERC) that could be used for routine inspection and maintenance by competent persons.

2.28 Training in the exact procedures should be given to all staff involved.

2.29 Some healthcare facilities may contain specialised units that are subject to access restrictions (for example pharmacy aseptic suites). Estates or contract staff requiring access may need additional training or be accompanied when entering the unit.

2.30 See also the following guidance published by the Health and Safety Executive:

- 'Safe working and the prevention of infection in clinical laboratories and similar facilities'.
- 'The management and operation of microbiological containment laboratories'.
- HSG 283 – 'Managing infection risks when handling the deceased: guidance for the mortuary, post-mortem room and funeral premises, and during exhumation'.

3.0 Ventilation systems – minimum standards

General requirements

3.1 All ventilation systems irrespective of when they were installed are to be inspected annually to ensure conformity with minimum standards required by the Building Regulations. These are designed to:

- assure the quality of intake air;
- ensure that extract air is discharged in a suitable location;
- prevent or control risks associated with Legionella and other potential hazardous organisms;
- ensure safe access when carrying out routine service and maintenance activities;
- provide documentary proof of performance.

3.2 All AHUs and their associated ventilation systems should achieve the minimum standard set out below.

Note:

These standards have not changed since Health Technical Memorandum 2025 was issued in 1994 so all systems currently in use should therefore achieve them.

Location and access

3.3 All ventilation plant should be secured from unauthorised access.

3.4 It is a requirement to uniquely identify individual plantrooms on site and fix a list just inside the door detailing the major plant elements within and the areas that they serve.

3.5 Plantrooms should, where possible, be provided with a sink so that glass drainage traps may be cleaned out and staff can wash their hands after handling dirty filters. A source of DHW with a hose connection point will also be required so that AHUs can be washed out internally as part of their routine maintenance.

3.6 Units located on roofs should have a safe and permanent means of access and adequate illumination as they may need to be accessed at any time. Suitable precautions should be in place to prevent personnel or equipment from falling off during maintenance activities.

3.7 Units located outside at ground level should be secured within a compound to prevent unauthorised access or preferably within a plantroom. Vehicles should be excluded from the vicinity to ensure that

exhaust fumes will not be drawn into intakes.

3.8 All parts of the AHU should be easily and safely accessible for routine inspection, service and maintenance.

3.9 The area around an AHU within a building should be tanked to prevent water penetration to adjacent areas, and should be adequately drained.

3.10 Fire precautions should be in accordance with the Health Technical Memorandum 05 series.

3.11 Combustion equipment must not be located in a fire compartment that houses air-handling equipment.

3.12 Plantrooms that house AHUs should not be used for general storage. Care should be taken to ensure that the amount of combustible material in a plantroom is kept to an absolute minimum. Ventilation stock such as filters should be kept in a central store.

3.13 If a spare set of filters is kept in the plantroom they should be kept in their original packing to preserve them from contamination and stored off the floor so that they cannot become wet. The number stored should be kept to a minimum to reduce the fire load in the plantroom. Used filters should be placed in an empty box or bag and removed immediately.

3.14 Spare fans should be stored on a purpose-built rack near the plantroom entrance. Staff should be instructed to "spin" the fan every time they enter the plantroom to help prevent the bearings settling.

Identification and labelling

3.15 All ventilation systems should be clearly identified with a permanent label in accordance with the requirements of paragraph 1.33 onwards. The label should identify both the AHU and the area that it serves. The lettering should be at least 100 mm high and be mounted in an easily visible place near the fan of the unit adjacent to the local electrical isolator. Any subsystems and the principal branch ducts should be similarly labelled as should any associated control panels.

3.16 The nature and direction of airflow should be clearly marked on all main and branch ducts (see BS1710).

3.17 All airflow test-points should be clearly identified with a permanent label and the design information given (for example TPS 1 – Anaesthetic supply; 400 × 300; Design 185 L/s).

Basic requirements

3.18 The ventilation system should not contain any material or substance that could support the growth of micro-organisms.

3.19 Access to items that require routine service, such as filters, fog coils and cooling coils, should be via hinged doors.

3.20 Items requiring infrequent access such as attenuators may be via clipped or bolted-on lift-off panels.

3.21 All doors and panels should be close-fitting and without leaks.

3.22 Access to plant and equipment above 1.5 m should be via platforms, fixed ladders, hook ladders, pulpit-style movable steps or access platforms.

3.23 Electrical and mechanical services should not restrict or impede access to those parts of the plant that require inspection.

3.24 Viewing ports and internal illumination should be fitted in order to inspect filters and drainage trays.

3.25 Internal illumination should be provided by luminaires to at least IP55 rating. Fittings are to be mounted inside the unit so that they provide illumination for inspection and task lighting when the access doors are open.

3.26 A single clearly labelled switch should operate all the lights in a unit.

AHU intakes and discharges

3.27 Intake and discharge points should not be situated where they will cause vitiated air to be drawn into a system (paragraph 9.30 onwards in Part A of this Health Technical Memorandum gives detailed information). In existing systems, it may be necessary to extend the intake or discharge point to a suitable position.

Note:

Steps should be taken to prevent birds landing or roosting in the vicinity by removing ledges or fitting anti-pigeon spikes.

3.28 Each intake and discharge point should be fitted with corrosion-resistant weatherproof louvres or cowls to protect the system from driving rain. The inside of the louvres should be fitted with a mesh of not less than 6 mm and not more than 12 mm to prevent infestation by vermin and prevent leaves being drawn in.

3.29 The duct behind a louvre should be self-draining. If this is not practicable, it should be tanked and provided with a drainage system. Cleaning access should be provided either from the outside via hinged louvres or by an access hatch or door in the plenum behind the louvre. Where a common plenum is provided, cleaning access should be via a walk-in door. If the intake plenum is a builder's work duct, all of its surfaces should be sealed to prevent dust being shed into the airflow.

Plant drainage system

3.30 All items of plant that could produce moisture should be provided with a drainage system. The system will comprise a drip-tray, borosilicate glass trap, air gap and associated drainage pipework.

3.31 Some older units may not have been mounted far enough above the floor to permit the correct installation of a drainage system. If the AHU cannot be raised to an adequate height, an alternative arrangement (such as a pump-out system) should be provided.

3.32 The drip-tray should be constructed of a corrosion-resistant material (stainless steel is preferred) and be so arranged that it will completely drain. To prevent "pooling", it is essential that the drain connection should not have an upstand and that a slope of approximately 1 in 20 in all directions should be incorporated to the drain outlet position.

3.33 In AHUs that have access doors large enough for a person to enter, the drip-tray should be easily accessible for inspection and cleaning.

3.34 In AHUs with access doors too small for a person to enter, the complete drip-tray should be capable of being withdrawn. It should be clamped into the AHU with thumbscrews so that it can be removed without the need for tools.

3.35 Each drip-tray should be provided with its own drain trap. The drain trap should be of the clear (borosilicate) glass type. This permits the colour of the water seal to be observed, thus giving an early indication of corrosion, biological activity or contamination within the duct (see Table 3 in Chapter 5).

3.36 The trap should have a means for filling and should incorporate couplings to facilitate removal for cleaning. It should be located in an easily visible position where it

will not be subject to casual knocks. The pipework connecting the drainage tray to the trap should have a continuous fall of not less than 1 in 20.

3.37 Traps fitted to plant located outside or in unheated plantrooms may need to be trace-heated in winter. The trace heating should be checked for operation. It should be ensured that the temperature of water in the trap does not exceed 5°C.

3.38 Water from each trap must discharge via a clear air gap of at least 15 mm above the unrestricted spill-over level of either an open tundish connected to a drainage stack via a second trap, or a floor gully (or channel) or directly onto a roof (if in a location that will not cause a slip hazard). A support should be provided to ensure that the air gap cannot be reduced. More than one drain trap may discharge into the tundish, providing each has its own air gap.

3.39 Drainage pipework from the tundish may be copper, thermoplastic or stainless steel. Glass should not be used. The pipework should be a minimum diameter of 22 mm and have a fall of at least 1 in 60 in the direction of flow. It should be well supported, and located so as not to inhibit access to the plant.

Dampers

3.40 All AHUs should be fitted with motorised low-leak shut-off dampers at their intake and discharge ends. The damper actuators should be fitted with end switches and be spring-return so that they close automatically on power failure. Note that all new plant will in addition have motorised dampers at the supply and return air ends of an AHU.

Fans and their drives

3.41 Belt-and-pulley fan drive-trains external to the AHU, whether supply or extract, should be easily visible without the need to remove access covers. Protecting the drive-train with a mesh guard is the preferred option. For weatherproof units located outside, the fan drive should be enclosed. It should be easily visible through a viewing port with internal illumination and be accessed via a lockable hinged door.

3.42 Plug and EC fan units are mounted inside the AHU. Their access door should have a viewing port and internal illumination. The door should be fitted with a two-stage opening latch so that if the door is inadvertently opened when the fan is running it will not blow outwards.

3.43 The motor windings of induction-drive "plug" motor arrangements, EC fans and in-line axial fans having a pod motor within the airstream must be protected from over-temperature by a thermistor and lock-out relay.

3.44 It is necessary to ensure that – should the computer control system or its software develop a fault – the fan in an AHU serving a critical healthcare application can be switched to a fixed speed and manual operation.

Heater-batteries

3.45 Access for cleaning will need to be provided to both sides of all fog coils and heater-batteries.

Cooling coils

3.46 All cooling coils, whether within the AHU or a branch duct, should be fitted with their own independent drainage system as specified above. A baffle or similar device in the drip-tray will prevent air bypassing the coil. The tray should be large enough to capture the moisture from the eliminator, bends and headers.

3.47 The cooling-coil control valve should close upon selection of low speed, system shut-down, low airflow or fan failure.

3.48 Where auxiliary wet cooling coils are located in false ceilings, they should be fitted with a catch tray and leak alarm. The catch tray should be installed under both the battery and the control-valve assembly to protect the ceiling from leaks. A moisture sensor and alarm should be fitted in the tray.

Eliminators

3.49 Where fitted they should be removable so that the face of the cooling coil can be inspected and cleaned as necessary. In new units the eliminator will be mounted on slide rails for ease of removal. In existing systems, if bolted in position it should be secured with thumbscrews (not tech/spire screws) and fitted with lifting handles to enable removal and replacement without the use of tools.

Humidifiers

3.50 Humidifiers are not generally required. Chapters 8 and 9 in Part A of this Health Technical Memorandum give examples of where humidification may be required.

3.51 Where they are fitted, but have been out of use for a significant period of time, they should be removed. All associated supply pipework must also be removed back to its junction with the running main. Their drainage trap should be removed and the tray capped off.

3.52 Where humidifiers are fitted and their use is still required, they should fully conform to the installation standard set out in Chapter 9 of Part A of this Health Technical Memorandum.

3.53 The section of ductwork containing the humidifier may need to be periodically decontaminated. Hinged access doors with viewing ports and internal illumination should be provided.

3.54 All humidifiers should be fitted with their own independent drainage system as detailed in paragraph 3.30 onwards.

3.55 Only steam-injection humidifiers, whether mains steam fed or locally generated, are suitable for use in ventilation systems within healthcare facilities. Water humidifiers, if fitted, must be removed.

3.56 Self-generating steam humidifiers must be supplied with wholesome water. The installation should be capable of being isolated, drained and cleaned.

3.57 Some steam generators require regular cleaning and descaling. The installation should enable them to be physically isolated from the air duct in order to prevent contamination of the air supply by cleaning agents.

3.58 The humidifier control system should fully conform to the standard set out in Chapter 9 of Part A of this Health Technical Memorandum.

Filtration

3.59 Filters should be securely housed in well-fitting frames that minimise air bypass. Air bypass significantly reduces filter efficiency; the higher the filter grade, the greater the effect. In horizontal AHUs the mounting frames should be designed so that the airflow pushes the filter into its housing to help eliminate air bypass. Supports with seals will master the joints between filters.

3.60 All filters should be of the dry type. Panel filters are generally used as prefilters and should be positioned on the inlet side of the supply fan, downstream of the fog/frost coil. Where required, secondary filters (these will be bags or pleated paper) should be on the positive-pressure side of the fan.

3.61 The filter installation should provide easy access to filter elements for cleaning, removal or replacement; therefore, a hinged access door should be provided. The upstream side of the filter should be visible for inspection through a viewing port with internal illumination.

3.62 All filters should be provided with a means of checking the differential pressure across them. Direct-reading dial-type gauges marked with clean and dirty sectors are preferred.

Note:

Direct-reading gauges may be omitted (if desired) providing the filter differential pressure is continuously monitored by a sensor connected to the BMS and there are capped tappings so that a portable gauge can be attached when required for diagnostic purposes or fault-finding.

Efficiency (EPA) and high-efficiency (HEPA) filters

3.63 Where fitted, EPA or HEPA filters should be of the replaceable-panel type with leak-proof seals. Their installation should permit the validation of the filter and its housing.

3.64 EPA or HEPA filters fitted in supply ducts should have a metal case so that they cannot support fungal growth.

3.65 EPA or HEPA filters are sometimes used in extract systems to prevent the escape of hazardous substances or organisms. They may be supplied with a particleboard or plywood case so that they can be disposed of by incineration.

3.66 When used for the containment of hazardous substances, the installation should incorporate design provision for the subsequent safe removal and handling of contaminated filters by maintenance staff (see paragraph 5.16).

Notes:

1. In view of the costs and problems associated with placing EPA or HEPA filters in extracts, it is essential that a full risk assessment be carried out in conjunction with the VSG. It should include defining the true need for a filtered extract, the validation of its performance at installation, the method of safely changing a contaminated filter, and its subsequent disposal.

2. General extracts from mortuaries and post-mortem rooms may contain odours, but these are not in themselves hazardous to health and do not require filtration prior to discharge. In high-risk post-mortems (for example, known or suspected tuberculosis cases), the infected organs will be removed and then dissected in a class 1 microbiological safety cabinet provided under the COSHH Regulations. Extracts from infectious disease Isolation rooms or wards do not normally require filtration prior to discharge. However, if the discharge cannot be made in a safe location and it is likely that the vitiated air could be drawn back into the building or there are people in its vicinity (for example, a discharge into a courtyard), filtration would be required.

Energy recovery

3.67 Energy recovery, where fitted, will require cleaning access to both sides of the device.

3.68 Whichever type of energy recovery device is fitted, the extract side should be protected by an ISO ePM10 $\geq$ 50% filter and

provided with a drainage system to remove condensate.

3.69 The energy-recovery device should be controlled in sequence with the main heater-battery, and may need to incorporate a control to prevent the transfer of unwanted heat when the air-on condition rises above the plant's required set-point.

Attenuation

3.70 Cleaning access should be provided at both ends of any attenuator unit.

Pressure stabilisers

3.71 Pressure stabilisers should be unobstructed and silent in operation. (See Chapter 5 for maintenance requirements.)

3.72 Pressure stabilisers that direct air into a UCV operating theatre will need to be baffled on the theatre side to prevent the air jet disturbing the UCV canopy air pattern. Pressure stabilisers between the theatre and anaesthetic room may also need to be baffled if the jet of air from them creates uncomfortable conditions for patients or staff.

3.73 Where a pressure stabiliser incorporates a fire and smoke damper, the damper test switch or trip mechanism should be accessible from the corridor side without the need to remove the grille face, if fitted.

Chilled beams – active and passive types

3.74 Chilled beams should not be installed above a patient's bed or diagnostic medical equipment without the agreement in writing of the VSG. Where currently fitted they should be easily accessible for cleaning and in a room with openable windows should have a switch to automatically turn them off when the windows are opened (see paragraph 5.18 onwards in Part A of this Health Technical Memorandum).

Stand-alone air-conditioners

3.75 Stand-alone air-conditioners include fan coil units, split-comfort air-conditioners, room conditioners and cassette units. They should not be installed above a patient's bed or diagnostic medical equipment and should be easily accessible for cleaning.

3.76 To avoid fungal-spore contamination, the ceiling void should not be used as a plenum either for supply, extract or as a return air path. All air connections will be ducted directly to the fan coil unit and ceiling terminals.

Portable air-conditioners

3.77 Portable air-conditioners are not recommended for use in healthcare premises. The need for them is to be assessed by the VSG for every occasion that they are requested. If used they will be subject to a strict cleaning and maintenance regime (see Chapter 5). Units no longer required will need to be stripped down, cleaned and decontaminated before being used again.

3.78 Stand-alone units that draw in outside air should do so through a bespoke sealable air intake through a wall, roof or window. They should not just be placed in front of an open window.

Portable recirculating filter units

3.79 The need for portable recirculating air-filter units will be risk-assessed by the VSG for every occasion that they are considered. If used they will be subject to a strict cleaning and maintenance regime (see Chapter 5). Units no longer required will

need to be stripped down, cleaned and decontaminated before being used again.

Low-level extracts

3.80 Low-level extracts should not be obstructed by fixed or portable equipment, furniture or fittings. If necessary, stand-off guarding will need to be fitted.

3.81 Low-level extract grille faces should be of the pull-off type to facilitate routine cleaning. (See Chapter 9 in Part A of this Health Technical Memorandum for further information.)

Fire and smoke dampers

3.82 All fire and smoke dampers must be fixed directly to the fabric of the building. They should have an access door with a test switch adjacent so that the actual operation of the damper can be directly observed during the annual test and be undertaken by a single operative. (See also the Health Technical Memorandum 05 series for detailed guidance.)

Control panels

3.83 Ventilation control panels of any type and purpose must be clearly marked with the unique identifier of the plant that they control and the area/zone that the plant serves.

3.84 Inverters are not to be located within the airstream inside an AHU. They should be mounted externally with the readouts of their control pads and plant data screens visible at a convenient height. Their settings may be password-protected but they should be able to be switched to manual, without the need to isolate plant or unlock access panels.

Theatre, imaging and treatment room panels

3.85 Local control panels should have a clear means of indicating that the ventilation is operating to a satisfactory standard for the application. The minimum requirement would be a green light for "On" and a red light for "Set back", "Off" or "Fault". The panel should also display the room temperature and have a means of adjusting it. (See Chapter 9 in Part A of this Health Technical Memorandum.)

Note:

The Specialised Ventilation for Healthcare Society's (2017) SVHSoc.01 – 'Operating theatres: energy control strategies and the surgeon's panel' provides additional information of minimum standards for a variety of panel types.

Energy efficiency

3.86 The basic objective will be to provide the necessary service utilising the least amount of energy possible. To this end switching a system "Off" when not required is the most energy-efficient policy.

3.87 If the system is needed to maintain a minimum background condition then reducing its output to the minimum necessary to achieve and maintain the desired condition is the next best option.

Note on "Set back":

In many existing systems the fan motor has two speeds so turning the system down means switching to the lower fan speed and hence air volume. With inverter-controlled or EC fans the speed can be adjusted across a wide range so "Set back" need not be a fixed fan speed but rather a control strategy that reduces the system output in order to

maintain a desired minimum condition. This may be related to the air velocity at a fixed point, air-change rate, pressure differential, temperature, humidity or a combination of any of these parameters.

3.88 The system should only run at full output when needed to achieve and maintain the defined "in use" operational condition.

3.89 Care should be taken to discover the true "in use" operational condition. Overstating the condition will lead to oversized plant, unstable control and excessive energy consumption.

3.90 A ventilation system should not be run at full output "just in case it will be needed". This is particularly a problem in operating departments where the ventilation is often run out of hours as it is believed that it will "maintain sterility" in the operating suite. This is not true as airborne contamination in operating theatres is caused by the people in them when they are in use. The theatre ventilation is provided to cater for this "in use" biological load. When the theatre is not in use, there is no biological load so the ventilation can be turned off and set to automatically start at "Set back" (see above note) in order to maintain a minimum background condition, for example room temperature, if needed. The time taken to start the ventilation and achieve full operating conditions in an emergency will be less than the time taken to bring a patient to theatre and prepare the staff and instruments ready for emergency surgery to commence. A similar situation applies to obstetrics theatres and "special" delivery rooms.

Note:

UCV theatre ventilation can be completely switched off when the theatre is not in use but the room temperature should not be allowed to drop below 18°C (see also paragraph 8.96 in Part A of this Health Technical Memorandum). The AHU and UCV control should be interlocked so that when the AHU goes to "Set back" the UCV also goes to "Set back", and if the AHU goes "Off", the UCV terminal fans also switch "Off". There is no aerobiological benefit in keeping the UCV terminal fans running when the theatre is not in use, it merely wastes energy.

3.91 The selection of set points for an AHU and associated extract system will have a significant impact on the overall energy consumption and efficiency of the system as a whole.

3.92 The control strategy for existing systems should be reviewed in line with the above guidance. (See Chapters 6 and 9 in Part A of this Health Technical Memorandum for further information.)

Note:

Energy-recovery devices have been mandatory for all new and refurbished AHUs since 2016. Where installed they provide a significant portion of the heating requirement, and the size of the AHU heater-battery will have been reduced as a consequence. It is therefore essential that the energy-recovery device operates as intended and is well maintained.

4.0 Annual inspection and verification requirements

Ventilation systems inspection

4.1 All ventilation systems will be subject to at least a simple visual inspection annually.

4.2 The purpose of the inspection is to establish that:

- the system is still required;
- the plant conforms to the minimum standard (see Chapter 3);
- the fire containment has not been breached;
- the general condition of the system is adequate for purpose;
- the system overall is operating in a satisfactory manner.

4.3 It is recommended that a simple check sheet be used to record the result of the inspection. Examples are given in Appendices 1 and 2.

Critical healthcare ventilation systems

4.4 All critical healthcare ventilation systems will be inspected quarterly and verified at least annually. In some circumstances the verification may need to be carried out more frequently.

4.5 The quarterly inspection should be as detailed in paragraphs 4.1–4.3.

4.6 The purpose of the annual verification will be to additionally ensure that the system:

- achieves minimum standards specific to the application;
- is operating to an acceptable performance level;
- remains fit for purpose.

Definition of a critical system

4.7 Ventilation systems serving the following are considered critical:

- operating suites of any type including rooms used for interventional procedures and their recovery areas;
- airborne isolation facility;
- critical care units, neonatal and special care baby units;
- invasive treatment, endoscopy and bronchoscopy rooms;

- containment level 3 laboratory;
- pharmacy aseptic suite;
- inspection, assembly and packing (IAP) room in a sterile services department;
- MRI, CAT and other types of emerging imaging technologies that require particularly stable environmental conditions to remain within calibration;
- any system classified as an LEV system under the COSHH Regulations;
- any other system that clearly meets the definition that "a loss of service from such a system would seriously degrade the ability of the premises to deliver optimal healthcare".

Note:

If any doubt exists as to whether a system falls within this definition, the VSG should be consulted regarding the risk to patient safety and business continuity.

Annual verification

4.8 The annual verification is intended to establish that:

- the system is still required;
- the AHU conforms to the minimum standard (see Chapter 3);
- the fire containment has not been breached;
- the general condition of the ventilation system is adequate;
- the fabric of the area served is suitable for the function;
- the system performance is adequate with respect to the functional requirement – this will require:
  - the measurement of all system supply and extract airflow rates;
  - the calculation of room air-change rates if applicable;
  - the measurement of room differential pressures if applicable;
  - the measurement of room noise levels;
  - temperature, humidity and any application-specific air velocity measurements;
  - a check of the control functions;
  - microbiological air-quality sampling if required;
  - any other application-specific tests or measurements as required.

4.9 An assessment should then be made by the AP(V) as to whether the system overall is fit for purpose and operating in a satisfactory manner. If any doubt exists the AE(V) and/or VSG should be consulted.

Fabric of the area served

4.10 The building elements in the room or rooms served by a critical ventilation system should also be suitable for the function. As an example, in a suite of rooms comprising an operating theatre complex, the following elements should be checked:

- the ceiling should be complete and free from holes, gaps, cracks or obvious air leakage paths. All light fittings, access hatches and suspended fittings should be sealed to prevent uncontrolled air leakage. It is important to check for air-leakage paths behind the cover shrouds where operating-lamp stems and medical-gas and monitor-suspension booms penetrate the ceiling;

- the walls and floors should be free from significant construction and finish defects;
- windows and their trickle vents should be sealed and locked shut;
- the doors should close completely, and the door closers should be correctly adjusted to hold them against the room pressure gradient;
- all service penetrations should be sealed to prevent uncontrolled airflow between rooms and service voids;
- steps should be taken as necessary to prevent portable equipment and stock items from obstructing low-level supply, transfer or extract airflow paths.

4.11 Failure to achieve a suitable standard will render even the most sophisticated ventilation system ineffective.

4.12 All fire and smoke dampers should be tested as part of the annual verification unless the local policy dictates otherwise.

4.13 Table 1 provides a model for the verification of critical ventilation systems.

4.14 LEV systems will be subject to an examination and test by a competent person at least every 14 months. An individual who holds an in-date P601 certificate will be considered competent.

Critical healthcare ventilation systems – verification standards

Note:

The following standards apply to the performance of all existing in-use ventilation systems. Performance standards for new or refurbished systems are given in Chapter 12 in Part A of this Health Technical Memorandum.

4.15 When measured at the annual verification the following air change rates should be achieved:

a. The primary air supply to a conventionally ventilated operating theatre, UCV operating theatre or "lay up" preparation room, regardless of when it was built, should not result in fewer than 18 air changes per hour in the room.

Note:

If the scrub is in effect a separate room that is open (no door) to the operating theatre and it has a low-level pressure stabiliser discharging onto a corridor or an active low-level extract at its far end, so that air has to travel through the scrub to leave the operating theatre, then the volume of the scrub will not be counted as being a part of the operating theatre room volume.

If the scrub is a trough on the wall or in an open bay within the operating theatre, the volume of space it occupies will be considered part of the operating theatre room volume for the purpose of calculating the operating-theatre air supply.

b. The primary air supply to an operating suite anaesthetic room that is equipped with a N_2O (nitrous oxide) terminal or in which an anaesthetic agent is delivered to the respiratory tract of a patient using a carrier gas or an operating department recovery room should not result in fewer than 12 air changes per hour.

c. The primary air supply to any other room that is fitted with a N_2O (nitrous oxide) or N_2O/O_2 (entonox) terminal or in which an aneasthetic agent is delivered to the respiratory tract of a patient using a carrier gas

or in which the patient is subsequently recovered should not result in fewer than 8 air changes per hour. (Note that in these rooms the patient is generally only sedated rather than fully anaesthetised.)

4.16 Unless otherwise specified in paragraph 4.15 above, for all other applications the ventilation system should achieve not less than 80% of the design air-change rate given in Chapter 8 and Appendix 2 of Part A of this Health Technical Memorandum, or its original design parameters.

Note:

It is to be expected that over the lifetime (typically 20 years) of a ventilation system its performance will gradually reduce due to wear in components, increasing friction due to internal surface degradation and ductwork

Table 1
Operational management and routine verification process model

Step	Question	Information/standard required	Comment
1	Is the system still required?	Why was it installed?	Is that function still required?
2	Does the AHU achieve the minimum standard?	• Health and safety aspects • Intake/discharge positions • Inspection access • *Legionella* control and drainage • Fire and electrical safety • Leaks, cleanliness and insulation • Filtration	Inspect to ascertain compliance with minimum standards set out in Chapter 3 of Health Technical Memorandum 03-01 (Part B)
3	Is the air distribution system satisfactory?	• Access • Fire dampers • Cleanliness • Insulation • Identification • Room terminals • Pressure stabilisers	Inspect to ascertain continued fitness for purpose
4	Does the measured system performance still accord with the design intent and achieve a minimum acceptable standard?	• Design air velocities • Design airflow rates • Room air-change rates • Pressure differentials • Noise levels • Air quality	Establish the design values Measure the system output to verify its performance
5	Does the control system function correctly?	• Desired environmental conditions • Control sequence logic • Run; set-back; off philosophy	Establish the true "as used" requirement Inspect/test to verify performance
6	Having regard to the foregoing, is the system "fit for purpose" and will it only require routine maintenance in order to remain so until the next scheduled verification?		Yes or No!
7	What routine service and maintenance will be required for the system to remain fit for purpose and function correctly until the next scheduled verification?	• Filter changes • System cleaning • Performance indication • Performance monitoring • Performance measurement	Decide inspection frequency and maintenance schedule

and access door seals breaking down over time. However any rapid change in performance should be thoroughly investigated as it is likely to be caused by a failure of a component or control software. Trend analysis of the annual verification results will highlight sudden changes in performance.

4.17 The pressure regime should achieve not less than 80% of the design value given in Chapter 8 and Appendix 2 of Part A of this Health Technical Memorandum, or its original design parameters; and the pressure gradient relationships with regard to surrounding areas should be maintained.

4.18 The sound levels given in Table 2 are maximum permissible levels and should not be exceeded. Measurements should be made using at least a Type 2 sound meter fitted with a muff. Its accuracy should be checked using a calibration sound source before use.

Vertical flow ultra-clean ventilated (UCV) operating theatres

4.19 The following additional measurements should be taken:

- the average air velocity at the 2 m level under the UCV canopy: it should achieve a minimum average of 0.38 m/s for a partial or no wall system and 0.3 m/s for a full wall system when all four walls are in place;
- the average air velocity at the 2 m level for each quadrant or actively ventilated section of the UCV canopy should not exceed ±6% of the measured average velocity for the whole canopy at 2 m;
- the air velocity within the inner zone at the 1 m level: every reading should achieve a minimum velocity of 0.20 m/s.

4.20 The air velocity measurements are to be taken using the equipment, test grid and method set out in Chapter 12 in Part A of this Health Technical Memorandum.

Note:

There is no requirement to carry out a filter scan or entrainment test at the annual verification unless the EPA filters or recirculating air fans are changed, or the system in some other significant way is disturbed or altered. Changing the filters in the AHU or the recirculating air filters in the UCV canopy does not constitute a significant disturbance to the UCV unit.

Table 2
Maximum sound levels (service noise only) for existing systems

Area	Room Overall noise level – dB(A)
Operating suite including prep, operating theatre, anaesthetic, scrub and utility. Interventional and diagnostic imaging suites – all rooms	50
UCV Operating theatre and adjacent open-plan areas only	55
Treatment rooms, Consulting rooms, Sleeping areas, Recovery rooms	35
Pharmacy aseptic suites – all rooms	45
Sanitary facilities	45
Industrial areas	50
Circulation areas	50

Note: Health Technical Memorandum 08-01 gives detailed guidance on acoustics and the measurement of sound

4.21 Should the UCV canopy fail to achieve a suitable standard, resulting in the need to disturb or replace the canopy EPA filters or its auxiliary fans, the unit should be revalidated using the procedure given in Chapter 12 in Part A of this Health Technical Memorandum.

Horizontal flow ultra-clean operating theatre terminals

4.22 The following additional measurements should be taken:

- A line of test positions should be marked on the floor 1 m in front of the face of the UCV terminal.
- A test position will be marked in the centre of the line. Additional test positions will be marked at 280 mm spacing along the line either side of the centre position, up to the full face width of the unit.
- The discharge velocity test at 1 m, 1.5 m and 2 m levels in front of the terminal are taken at each test position.
- The average velocity should be not less than 0.40 m/s.

4.23 The measurements are to be taken using the equipment and method set out in Chapter 12 of this Health Technical Memorandum.

Note:

There is no requirement to carry out filter scanning at the annual verification unless the EPA filters or recirculating air fans are changed; or the system is in some other significant way disturbed or altered.

Changing the filters in the AHU or recirculating air filters does not constitute a significant disturbance to the UCV terminal.

4.24 Should the horizontal UCV fail to achieve a suitable standard, resulting in the need to disturb or replace the canopy EPA filters or auxiliary fans, the unit should be revalidated using the procedure given above.

Containment level 3 laboratories

4.25 These areas should conform to the requirements of current information published by the Advisory Committee on Dangerous Pathogens and the Health and Safety Executive:

- 'The management, design and operation of microbiological containment laboratories'
- 'Biological agents: managing the risks in laboratories and healthcare premises'
- 'Biological agents: the principles, design and operation of Containment Level 4 facilities'.

4.26 The Head of Department will be able to advise on any mandatory plant inspection and maintenance frequencies and particular control strategy. The performance measurement of a containment laboratory is normally contracted out to a specialist.

Pharmacy aseptic suites

4.27 Pharmacy aseptic suites should conform to the requirements of the European guide to good manufacturing practice (https://ec.europa.eu/health/documents/eudralex/vol-4_en) and the requirements of the Medicine Inspectorate if a licensed manufacturing unit.

4.28 The Chief Pharmacist will be able to advise on any mandatory plant inspection, maintenance frequencies and particular control strategy. The performance measurement of the aseptic suite is normally contracted out to a specialist.

Sterile services department – IAP

4.29 IAP rooms should conform to BS EN ISO 14644 Class 8, and any additional requirements for the processing of medical devices, as applicable (see also Health Building Note 13 – 'Sterile services department').

4.30 The Head of Department will be able to advise on any mandatory plant inspection, maintenance frequencies and particular control strategy. The performance measurement of the IAP room is normally contracted out to a specialist.

Local exhaust ventilation (LEV) systems

4.31 LEV systems should conform to the latest version of the Health and Safety Executive's guidance document HSG258 'Controlling airborne contaminants at work: a guide to local exhaust ventilation (LEV)'.

4.32 LEV systems must be examined and tested at least every 14 months by a competent person. The person must hold an in-date P601 certificate.

4.33 Each LEV system must be examined and its performance measured and/or visualised from the point of capture of the hazard to its point of discharge. A full report of findings and a clear statement as to whether the system does or does not achieve an acceptable standard must be provided by the inspector.

Note:

Having an annual service contract for an item of equipment such as a safety cabinet does not necessarily fulfil the statutory requirement for an annual LEV examination. The annual LEV examination must test and quantify the performance of the complete system including the location of the item, its interaction with any room ventilation, its discharge arrangement and suitability of the discharge location.

Critical system verification failure

4.34 Should a critical system be unable to achieve the standard set out above, it should not be returned to service and the duty manager who signed the system over for the annual verification will need to be informed immediately. Copies of the verification report stating the reason(s) for non-compliance should be sent to the head of the user department, nominated infection prevention and control person and the healthcare provider's AP(V) as soon as practicable.

4.35 If a critical system is refurbished in order to bring it to a suitable standard, it will be subject to the full validation procedure set out in Chapter 12 in Part A of this Health Technical Memorandum or other application-specific guidance as appropriate before being taken back into use.

5.0 Routine inspection and maintenance

General

5.1 Inspection and maintenance activities should be risk-assessed to ensure that they do not create a hazard for those who undertake the work or for those who could be affected by it.

5.2 The degree and frequency of inspection and maintenance should relate to the function of the system, its location, its general condition and the consequence of failure.

5.3 Specimen inspection and maintenance checklists are given in the Appendices.

Inspection and maintenance of critical systems

5.4 The loss of service of these systems would seriously degrade the ability of the premises to deliver optimal healthcare. In order to ensure reliable service provision, critical systems should be subject to a quarterly inspection and maintenance regime.

5.5 For many of these systems an equipment release or permit-to-work certificate will need to be completed to ensure that taking the ventilation system out of service does not compromise the activities of the user department. In any event, it will be necessary to liaise with the user department when switching the system off to carry out routine inspection and maintenance.

Note:

A specimen equipment release certificate is given in Appendix 3.

AHU routine inspection

5.6 All AHUs should be visually inspected at least every three months. The inspection should note the general condition of the unit in terms of:

- its external and internal condition;
- pipework and electrical connections;
- sensor and control elements;
- the unit's continued ability to maintain the desired condition in the spaces that it serves.

Note:

Where fitted, energy-recovery devices provide a significant portion of the

heating requirement, and the size of the AHU heater-battery will have been reduced as a consequence. It is therefore essential to check that the energy-recovery device operates as intended.

AHU drainage

5.7 AHU drainage systems comprise a drainage tray, glass trap, connecting pipework and an air gap. The system should be inspected to ensure that it is clean and operating correctly. The cleanliness of the drainage tray and colour of the water in the trap will give an indication of a fault condition (see Table 3).

Filter changing

5.8 Dirty supply air filters may pose a general dust hazard when being changed.

5.9 Dirty extract and return air filters may pose an increased level of hazard. This will relate to the particular contamination within the air that they have filtered. Filters handling extract air from general areas are unlikely to present a significantly greater hazard than that posed by dirty supply air filters.

5.10 Care should be taken to protect staff from inhaling the dust. If there is a need to enter the duct when changing filters, a dust mask or respirator to BS EN 149 should be worn. Dirty filters should be carefully removed and placed in a bag or the box that contained the replacement filters. On completion of the work, the dirty filters should be removed from the plantroom and disposed of appropriately.

Note:

Dirty general supply or extract filters are not classed as hazardous waste.

5.11 The duct in the area of the filter housing should be carefully vacuumed using a cleaner with a filtered exhaust before fitting the replacement filters. This will prevent particles (that is, those that are shed when the dirty filters are disturbed) being blown downstream into the system when it is switched on.

5.12 It is important to ensure that replacement filters are fitted in the correct orientation. Most panel filters are manufactured with a membrane or wire support mesh on their downstream side. Alternatively they may be colour-coded. The manufacturer's instructions regarding fitting should be followed.

5.13 Bag filters should be fitted with the pockets vertical. Care should be taken to remove any transit tapes and to ensure that the individual pockets are separate and free to inflate.

Note:

The preferred option is to replace bag filters with rigid assembly filter packs; however, whichever type is fitted, it is vital not to puncture or damage them during installation.

5.14 Whichever type of filters are fitted it is essential to ensure that air cannot bypass them.

Changing extract filters containing hazardous substances

5.15 Filters handling extract air from an LEV system will present a hazard and should be subject to a safe system of work.

5.16 Filters used in an extract system for the containment of hazardous substances or organisms should incorporate design provision for their safe removal when so contaminated. This may be achieved by:

- coating the filter with a water-based paint to seal the hazardous substance onto the filter prior to removal;
- a system to fumigate the filter to kill any organisms;
- housing it in a "safe change" unit that permits the filter to be ejected into a bag and sealed without staff having to come into direct contact with it.

The method chosen should reflect the nature of the hazard.

5.17 Filters fitted to remove hazardous substances from extract air are classed as hazardous waste and should be handled and disposed of accordingly.

Air terminals

5.18 Sooty marks around supply terminals should be vacuumed or wiped clean. Excessive soot marks around supply diffusers indicate an inadequate filter or significant filter bypass.

5.19 Extract grilles need to be regularly cleaned to remove dust and bits of fluff. Low-level spring-retained extract grilles should be regularly pulled off so that they can be washed and the debris in the duct behind them vacuumed out.

UCV canopies

5.20 UCV canopies fitted with perforated plate-type diffusers should have them removed and both sides wiped clean at the quarterly inspection. Any canopy side screens should be wiped down on both sides to remove surface contamination and bone dust.

5.21 UCV canopies fitted with monofilament diffuser screens do not need to be removed as blood splatter does not easily penetrate. Any visible surface contamination should be carefully wiped off in accordance with the manufacturer's instructions. If the monofilament screen is cut, punctured or physically damaged it will need to be replaced, not repaired.

5.22 The return air grilles for all types of canopies will need to be regularly cleaned to remove lint and the return air filters replaced as necessary.

Pressure stabilisers

5.23 Plate and bar stabilisers need to have their screws tightened, pivots cleaned and adjusted, and the sorbo rubber stop inspected and replaced as necessary if they are to operate correctly and silently.

5.24 All types of pressure stabilisers to be checked for correct and silent operation and cleaned as necessary.

Note:

Pressure stabilisers may need to be retrofitted with a stand-off baffle on their discharge side to preserve privacy or prevent discharge air causing draughts within an anaesthetic room or bedroom. A stand-off baffle will always be needed on the theatre side of the pressure stabiliser between a "lay-up" preparation room and a UCV theatre to prevent perturbation of the UCV canopy air pattern.

Transfer grilles

5.25 Both sides of a transfer grille should be vacuumed to remove dust and fluff.

Ventilation system cleaning

5.26 The intake section of a ventilation system should be vacuumed-out as necessary to remove visible particles.

5.27 AHUs should be vacuumed-out and wiped or washed down internally as necessary to remove obvious dust and dirt.

5.28 Drift eliminators (if fitted) should be removed, and cooling coils, humidifier units, energy-recovery devices and their drainage systems should be washed down with hot water annually to remove visible contamination. Using a hose connected to the DHW is the simplest way. Pressure washers should not be used as they will damage the battery fins or energy transfer matrix.

5.29 Supply air distribution ductwork conveys air that has been filtered. It will require internal cleaning only when it becomes contaminated with visible dirt. The frequency of cleaning will depend on the age of the system and grade of the AHU final filter but will typically be in excess of ten years. There is no requirement to clean supply ductwork annually. A rapid build-up of visible dirt within a supply duct is an indication of a failure of the filtration or its housing.

5.30 On completion of cleaning, the supply ductwork should not be "fogged" with chemicals. This treatment has no lasting biocidal effect and is responsible for initiating the breakdown of the galvanised coating of ductwork. This results in accelerated corrosion of the inside of the duct, with the products of corrosion being shed into the air stream. It will also significantly shorten service life.

Note:

If after duct cleaning there are persistent problems with fungal spores being discharged from the supply terminals and there is no evidence of final filter bypass, air samples should be taken at the AHU intake, AHU discharge and at least one supply terminal in each branch of the system. This should pinpoint the actual source of the problem. The affected section should then be inspected and cleaned and finally fogged only if that proves to be necessary.

5.31 Extract air systems handle unfiltered air. They should be cleaned as frequently as necessary in order to maintain their operating efficiency. Room extract terminals, particularly those sited at low level in critical care areas, will need regular cleaning.

Table 3 Colour of water in glass trap

Colour of water	Probable cause and comment
Normal	Satisfactory
Green	Copper corrosion of pipework Possible leak in battery tubing
White	Aluminium corrosion of battery fins
Black	General dirt Filter faulty allowing air bypass Possible *Aspergillus* contamination System is overdue for a thorough clean Urgent action required
Brown/Red	Iron corrosion (rust) within the AHU which may indicate a specific *Legionella* hazard Immediate action required
Bubbly/slimy	Microbiological activity within the AHU which may indicate a specific *Legionella* or similar hazard Immediate action required
Dead wildlife	Failure of filtration – immediate action required

5.32 Following duct cleaning, all service hatches should be checked to ensure that they have been correctly replaced and do not leak.

5.33 Duct-cleaning equipment that uses rotating brushes or a vacuum unit can easily damage flexible sections of ductwork. On completion of cleaning, all flexible duct sections should be checked for rips and tears. The opportunity should be taken to reduce flexible ducts in length to the absolute minimum and replace any being used in lieu of bends with rigid duct sections. The straps that secure them to rigid duct sections and air terminals should also be checked to ensure that there is no air leakage.

Note:

If the system has mixing or VAV boxes, the cleaning contractor should be alerted and use a method that avoids damaging any internal acoustic lining.

Note:

Duct-mounted sensors and the elements of electric and fins of heating or cooling trimmer batteries can also be easily damaged during duct cleaning. Sensor probes may need to be temporarily removed and the battery elements protected during the process.

5.34 It is always necessary to re-balance the ventilation system following cleaning as balance dampers and registers will have been disturbed. The system will then need to be validated in accordance with Chapter 12 in Part A of this Health Technical Memorandum.

Chilled beams – active and passive types

5.35 The efficiency of these units will rapidly decline if they become blocked with fluff/lint. They should be inspected every three months and cleaned as appropriate.

Split and cassette air-conditioning units

5.36 These units incorporate internal recirculation air filters and a drainage system to remove condensate from the cooling coil. The systems should be inspected and cleaned every three months and the drainage system checked.

Fan coil units

5.37 These units incorporate internal recirculation air filters and a drainage system to remove condensate from the cooling coil. The systems should be inspected and cleaned every three months and the drainage system checked.

Portable room air-conditioning units

5.38 Portable units are sometimes kept in-store or hired-in to cope with temporary local situations giving rise to excessive temperatures. They typically incorporate internal recirculation air filters and a drainage system to remove condensate from the cooling coil. The VSG should be consulted before these types of unit are deployed.

5.39 The units should be inspected and thoroughly cleaned before being taken into use. Units that are to be used in areas containing immunocompromised patients will, unless new, need to be fully decontaminated before use.

5.40 All portable units should be inspected and cleaned every week that they remain in use.

5.41 Units that have been used in isolation rooms or areas containing infectious patients will need to be fumigated before being used in other locations, returned to store or to the supplier.

5.42 Units employing an internal water reservoir and wick to promote evaporative cooling are not to be used in healthcare premises.

Self-contained mobile filter and/or ultraviolet (UV) light units

5.43 The VSG will be consulted before these types of unit are deployed. The efficacy of these units is directly related to their cleanliness. In this respect, the manufacturer's instructions regarding initial use, service and maintenance, lamp and filter replacement should be closely followed (see also paragraph 3.79).

5.44 Units that have been used in isolation rooms or areas containing infectious patients will need to be fumigated before being used in other locations, or returned to store.

5.45 Filters fitted to remove hazardous substances from the recirculated room air are classed as hazardous waste and should be handled and disposed of accordingly (see also Health Technical Memorandum 07-01 – 'Safe management of healthcare waste').

Inspection and maintenance records

5.46 Records of inspection and maintenance activities should be kept for at least five years (see paragraphs 1.31 and 1.44).

Appendix 1 – Annual inspection of critical ventilation systems – AHU and plantroom equipment

Definition of terms used on survey form

General condition

End of useful life

This should be clear from the condition of the AHU and its associated services and plant. The main indicators will be:

- extensive internal and/or external corrosion of the AHU casing;
- failure of filter housings to prevent air bypass;
- general corrosion of heater and cooling battery fins, attenuator surfaces etc;
- significant failure to meet minimum standards;
- associated plant services and control elements in a poor condition or not able to fulfil their purpose;
- AHU aged 20 years or more.

Action: Urgent replacement indicated.

Poor

Should be fairly apparent but would include an assessment of the degree of corrosion; cleanliness of coils and batteries; quality of filter mountings and their ability to prevent air bypass; fan and drive train condition; the control system elements' ability to fulfil their function; condition of the access doors and inspection covers. The age of the AHU is generally less important.

Action: Extensive refurbishment or programmed replacement indicated.

Average

Some faults but generally free of significant corrosion, clean internally and conforming to minimum standards.

Action: Faults capable of correction at next maintenance period.

Good

Conforming to the minimum standards, obviously cared for and subject to routine maintenance.

Action: Routine maintenance will preserve standard of the equipment.

Compliance with minimum standards (questions 2 to 23, 32 and 33)

Poor

More than three answers are negative.

Action: Management action required by estates/facilities department.

Average

No more than three answers are negative.

Action: Maintenance action required.

Good

No answers are negative, full compliance.

Action: None.

Maintenance quality (questions 5, 12, 26 to 31 and 34 to 40)

Poor
More than three answers are negative.
Action: Management action required by estates/facilities department.

Average
No more than three answers are negative.
Action: Maintenance action required.

Good
No answers are negative.
Action: None.

Annual inspection of critical ventilation systems – AHU and plantroom equipment

Hospital

Plantroom

Air-handling unit **Age of unit**

Area served by unit

Date of survey **Name**

General condition: **End useful life** **Poor** **Average** **Good**

Compliance with minimum standards (Questions 2 to 23; 32 and 33) **Poor** **Average** **Good**

Maintenance quality (Questions 5, 12, 26 to 31, 34 to 40) **Poor** **Average** **Good**

No	Survey question	Yes	No	Comments
1	Plant running?			
2	Is the unit and its associated plant secure from unauthorised access?			
3	Is the unit safely accessible for inspection and maintenance?			
4	Is the air intake positioned to avoid short-circuiting with extract or foul air from other sources such as gas scavenging outlets?			
5	Are all inspection lights operating?			
6	Are motorised dampers fitted to the intake and discharge?			
7	For belt driven fans, is the drive visible without the need to remove covers?			
8	For plug and EC fans, is the fan visible through a viewing port?			
9	Is the cooling coil located on the discharge side of the fan?			
10	Is an energy-recovery system fitted? (state type)			
11	Are condensate drainage systems fitted to all energy recovery systems, cooling coils and humidifiers in accordance with Chapter 3 of Health Technical Memorandum 03-01, Part B?			

No	Survey question	Yes	No	Comments
12	Are drainage traps clean and filled with water? (see Table 3 in Health Technical Memorandum 03-01, Part B)			
13	Is the drain trap air break at least 15 mm?			
14	If a humidifier is fitted, state the type	–		
15	Is the humidifier capable of operation?			
16	Is there space to safely change the filters?			
17	Are there test holes in the principal ducts?			
18	Are the test holes capped?			
19	What is the general condition of the exterior of the AHU?	–		
20	Are the principal ducts lagged?			
21	What is the general condition of the associated control valves and pipework?	–		
22	Is the pipework adequately lagged?			
23	Is the system clearly labelled?			
24	Record prefilter differential pressure	–		
25	Record main filter differential pressure	–		
	Switch plant off. Fit padlock to isolator			
26	Did all motorised dampers close on plant shut-down?			
27	Is the vermin/insect screen clean?			
28	Is the intake section including the fog coil clean?			
29	Are the prefilters correctly fitted with no air bypass?			
30	Are all drive belts correctly aligned and tensioned?			
31	Is the cooling-coil matrix clean?			
32	Are all drip-trays fully accessible or capable of being removed for cleaning and have a fall to drain?			
33	Are the drainage trays stainless?			
34	Are the drainage trays clean?			
35	Is the internal base of the AHU free from any sign of ponding?			
36	Is the matrix clean for each heater-battery?			
37	Have the main filters been correctly fitted with no air bypass?			

No	Survey question	Yes	No	Comments
38	Is AHU and its associated main ductwork clean internally?			
	Energise plant			
39	Did unit restart satisfactorily?			
	Test automatic fan-motor change-over, if fitted			
40	Did automatic change-over operate satisfactorily?			

Additional comments

(For example: air leaks from access doors; control valves leaking or passing; general cleanliness of the area around the unit; or any other items of concern.)

Are there any issues of particular concern that would prevent the plant being taken back into use?

Competent Person/Authorised Person .....

Appendix 2 – Operating suite annual verification

Definition of terms used on survey form

Assessment of compliance with Health Building Note 10-01 and Health Technical Memorandum 03-01 (all questions relevant to the type of theatre)

Poor
Air-change rate is less than 18 per hour; room pressure differentials do not ensure a flow from clean to less clean areas; supply or extract air diffusers are not clean; pressure stabilisers not clean and/or not operating correctly; significant faults or failures of indicators on surgeon's panel; visible faults in the fabric of the suite; doors unable to close completely; general air of neglect.
Action: Urgent management action required.

Average
Air volumes and room pressure differentials approximate to the original design values; supply air diffusers clean but extracts visibly fouled; most pressure stabilisers clean and operating correctly; some of the indicators on the surgeons' panel not working; minor faults in the fabric and décor of the suite.
Action: Maintenance action required.

Good
Better than average.
Action: None.

Maintenance quality (all questions relevant to the type of theatre)

Poor
More than three answers are negative.
Action: Management action required by estates/facilities department.

Average
No more than three answers are negative.
Action: Maintenance action required.

Good
No answers are negative.
Action: None.

Annual verification of theatre ventilation systems
Theatre suite information

Hospital

Theatre name/no. **Type of Theatre**

Date of survey **AHU location & ID**

Name

Compliance with HBN & HTM **Poor** **Average** **Good**

Maintenance quality **Poor** **Average** **Good**

No	Survey question	Yes	No	Comments
1	Has the annual verification of the AHU been carried out?			
2	Are windows hermetically sealed?			
3	Are the ceilings in the theatre and prep room complete and sealed?			
4	Is the fabric of the rooms within the suite free of any significant faults?			
5	Are room light fittings correctly sealed?			
6	Do all doors close completely and hold against the room pressure?			
7	Are the pressure stabilisers operating correctly and silently?			
8	Are all supply and extract air terminals and pressure stabilisers visibly clean?			
9	Measure and record the operating theatre temperature	–		
10	Does this accord with that displayed on the surgeon's panel?			
11	Measure and record the operating theatre relative humidity	–		
12	Does this accord with that displayed on the surgeon's panel?			
13	Measure and record the supply and extract air flow in the principal ducts	–		
14	Measure and record the air flow at all supply and extract terminals	–		

No	Survey question	Yes	No	Comments
15	Does the derived air-change rate achieve at least 18 ac/h in the Theatre, 12 ac/h in the Anaesthetic room and at least 80% of the design flow in all other rooms?			
16	For UCV units, also measure and record the air velocities within the canopy using the method set out in Chapter 12 of Health Technical Memorandum 03-01 (Part A)	–		
17	Do the air velocities achieve the standard appropriate for the type of canopy?			
18	Measure and record the room differential pressures	–		
19	Do the room differential pressures ensure a flow of air from the clean to the less clean areas?			
20	Measure and record the noise levels in the principal rooms of the suite	–		
21	Do the noise levels fall below the limits set out in Table 2 of Health Technical Memorandum 03-01, Part B?			
22	Check the operation of all ventilation control functions represented on the surgeon's panel.	–		
23	Do the indicators accurately represent the operational state of the ventilation system(s)?			
24	For UCV systems: Are the UCV and AHU interlocked to ensure that the AHU runs at full speed when the UCV is at full operating speed or at low speed? (See HTM 03-01; Part B; Chapter 3; paragraph 3.90 Note.)			
25	With the UCV running at low speed, does the system maintain the standard of a conventional operating theatre?			
26	For all theatres: with the system running at set-back, does it maintain a flow of air from the clean to the less clean areas?			

Additional comments

(For example: the general décor; are the suite and its ventilation systems suitable for their designated functions?)

Are there any issues of particular concern that would prevent the suite being taken back into use?

Competent Person/Authorised Person .....

Appendix 3 – Equipment Release Certificate

Equipment release certificate

Certificate No: **Job No: .....**

Issuing Dept: ..... Date & time of issue: .....

Issuing officer (print name): .....

Issued to (print name and company): .....

This certificate is issued for the purpose of carrying out the following task. The MAINTENANCE / SERVICE / REPAIR (delete as appropriate and attach job card to certificate) of the equipment specified below. It is valid for 48 hours.

Location: ..... Equipment: ..... Serial No: .....

		Yes	No
1	Is the task routine for this equipment?		
2	Are you a fully trained service engineer or have you carried out this task at least 3 times previously?		
3	Has one of the following authorised personnel (circle the name) given permission for the service to take place? Authorised Person(s):		
	Note: If the answer to all of the above questions is YES, proceed to Step 4. If the answer to any of the above questions is NO, **do not proceed**. Return this Certificate to the issuing officer and obtain a Permit to Work.		
4	Obtain the signature of the person identified at Step 3 above. Name:..... Signature: ..... Date:.....		
5	Isolate the equipment and carry out the task.		
6	Reinstate all services and test-run the equipment.		
7	On completion, the person doing the work to print name, and sign. Name:..... Signature: ..... Date:.....		
8	Is the equipment serviceable? If YES, go to Step 9. If NO, isolate equipment and go to Step 10.		
9	Hand equipment back to the person identified in Step 4. Obtain signature. Name:..... Signature: ..... Date:.....		
10	Return this certifcate to the issuing authority. Receiving officer to sign. Name:..... Signature: ..... Date:.....		
	Note: The issuing authority to retain this certificate for 12 months		

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