Guidance note: for the Verification of Ventilation Systems

DRAFT

1. Introduction

Why have standards for checking on the performance of ventilation systems in Healthcare?

In short to give confidence to clients and organisations that their ventilation systems are fit for purpose and meet the requirements of statutory regulation, standards, published guidance in healthcare for example HTM 00, HTM 03-01.

Verification standards give clients a clear understanding what is needed to be able to demonstrate to others (if carried out correctly) that the annual checks as required by for example HTM 00 and HTM 03-01 have been completed and reported on clearly.

2. Background

There have been requirements in both HTM 00 and HTM 03-01 Part B for many years, for healthcare organisations to carry out annual verifications (together with other less detailed quarterly inspections all supported by a rigorous maintenance regime), these are a continuation of what was required in HTM 2025 and other industry standards for ordinary ventilation systems such as HVCA SFG 20 (now B&ES).

This gives to the owner/operator, a record of the Ventilation System condition and performance only when carried out to the requirements of the HTM and the other supporting documents.

Therefore the object of this document is to outline a standard format for a verification report that meets the requirements of the HTM, and therefore can be used as a record to demonstrate (if passed) the ventilation system is being maintained correctly, is in a compliant condition and performs correctly.

3. Statutory Requirements


The subject of ventilation for all non domestic installations is covered by the workplace (health safety and welfare) regulations 1992; in regulation 5 and 6 of the workplace regulations ACOP 2013, this deals with the maintenance of the workplace including ventilation and in regulation 6 the provision and suitability of ventilation in the workplace, there are other relevant sections to the suitability of the environment. These requirements have not substantially changed from the 1992 requirements.

This makes it very clear that suitable ventilation must be provided at all material times (as detailed in the HTMs and HBNs for the healthcare estate and supporting standards and guidance) and for the systems delivering this to be maintained such that they deliver appropriate ventilation (this demonstrated, by carrying out maintenance, tests and checks and recording them).
Control of substances hazardous to health ACOP HS(L)5: 2005

This requires for example ventilation systems that are used to control levels of microbes and chemicals for example, to remove these to safe levels and for the systems to be regularly tested to prove the levels are compliant.

This is in part achieved by the verification process and rigorous report, clearly confirming that the tests and checks have been completed (and passed) in the verification report. To comply additional tests supported by clear record may be needed, these defined in the ACOP and other statutory regulation, standard, guidance etc (not just HTM 03).

4. Guidance

4.1. HTM 00 policies and principles of healthcare engineering:2014

clearly requires

6.1 All personnel employed in the design, operation and maintenance of engineering services, including maintenance personnel and operators, should receive adequate, documented training. Personnel should not commence their duties until this training has been completed, competency has been validated and detailed operating instructions have been provided.

requires an inspections and verification

4.2. 5.36 Where the correct functioning of important components is not necessarily verified by the periodic tests prescribed for the engineering service, those components should be regularly tested, and reference to testing them should be included in the schedules of maintenance tasks. This applies, for example, to door interlocks that may only be required to perform their safety function when presented with an abnormal condition.

4.3. 5.37 Apart from those tasks, the maintenance programme should concentrate on verifying the condition of the critical engineering service and its components by means of testing and examination without dismantling. Parts that are working correctly should not be disturbed unnecessarily.

4.4. HTM 03-01 Specialised ventilation for healthcare premises Part A design and installation and part B Operational Management and performance verification: November 2007

also requires the verifications to be carried out.

1.29 Ventilation systems serving critical care areas should be inspected quarterly and their performance measured and verified annually.

and also requires, adequate, documented training

4.5. 3.2 Demonstrating the people working on the system have the appropriate knowledge.
5. Verification report format

The report should clearly communicate with all prospective readers, these include:

- Authorised Persons,
- Senior Operational Managers,
- Verifiers,
- Directors of estates and facilities,
- Authorising Engineers,
- Competent Persons

Therefore the report should be clearly understandable by many people operating at a variety of levels and with differing interests and technical abilities.

Therefore the report must include for example, key action points and timescales as well as the technical depth for those with technical knowledge, to understand to develop solutions where non compliances are found. The report has to be evidence based, so it has to demonstrate that the observations and measurements were taken correctly to the correct standards this being clearly evident in the report.

Whilst not a requirement of the HTM, the verification report offers an excellent opportunity for the technician/company to assist with recommendations to resolve any issues and demonstrate in depth knowledge.

Clearly with some reports currently being provided by verification companies this can be done.

As discussed above the report needs to communicate clearly at a number of levels, the sections/headings of the report should enable the reader to easily access the relevant information.

The following are recommended headings and content, that would result in the various stakeholders being able to access information appropriately and the verifier demonstrating full competence and compliance with the regulations and guidance already discussed.

The headings might be as follows:

1. Front cover
   - Including:
     - full address of site and system being verified,
     - date of verification,
     - date of report,
     - signature,
     - any other additional QA system requirements, of the client or verifier

2. Table of Contents
   - A list of the headings or sections of the report

3. Executive Summary
   - An overview of the important findings only, main recommendations, and a conclusion including a clear conclusion if the system meets the statutory requirements, regulation, standards and
4 Scope

Should state this verification report fully meets the requirements of HTM 03-01:2007 Parts A and B (note both parts because Part A is heavily referenced in the verification requirements in Part B)

Details the client stipulated exceptions, these might include a test of the fire dampers/barriers as these have been carried out by the client or one of its other contractors. Then as the verification is a report on the compliance of the system at a point in time, the verifier should be given the record/report of testing to report and form a conclusion on in the main body of the verification report. A copy of these tests could be incorporated as an appendix.

If the verifier inserts any exclusions, these must be clearly listed and the first statement must make it clear to the reader the verification does not meet the requirements as discussed earlier.

5 Background

An opportunity to record the reasons for the verification and any background to the report the reader might find informative.

6 System details

A description of the system and where it serves, should include basic details of the systems and how they operate. A paragraph or two in length, sufficient to demonstrate to the reader, the verifier clearly understands the ventilation system as a whole.

7 Available information

This is a list of information provided by the employer/client including:

- floor plans,
- duct drawings,
- previous Verification Reports
- previous Validation Report

Additionally any information by the verifier

If any information is not available, this should be recorded clearly in the conclusions and recommendations, for example no duct drawings, the conclusion can only be a fail as if it can only be assumed the AHU supplies air to the system how can there be a pass. The action being to obtain/survey the ventilation system and carry out verification.

8 AHU Schematic

A schematic of the AHU (including extract) this to include:

- all plant e.g. heaters, coolers, humidifiers, attenuators, dampers, motorised dampers,
- access doors (and recording those <500mm),
- access staging,
- traps,
- drains,
Also see section 6.

9 AHU Condition & Operation Survey

Record and measure where required.

Provide photographs, to illustrate the text

Also see section 6.

10 Plan of the ventilation system

A schematic plan of the ventilation system, including:

- location of Traverse Points,
- Fire Dampers or Fire/Smoke Dampers,
- Balance dampers,
- Any other information pertinent to the safe maintenance and operation of the ventilation system e.g. access and access doors (are they big enough)

For example, the smoke dampers, balance damper locations are shown on the schematic and recorded in the main text of the report.

And thereby demonstrating a detailed knowledge of the ventilation system including dampers as required by the HTM.

11. Plan of area served by the Critical Ventilation System

A plan showing the room names as they appear on the doors.

Record inconsistencies.

12. Survey of area and ductwork system serving the critical ventilation system

To illustrate the points and compliance issues needing resolution along with the text a supporting photograph aids the understanding of the reader.

For other requirements also see section 6.

13. Airflow Measurements

A record of the air flow measurements of the whole system (supply and extract), how they were undertaken and to which standard e.g. BSRIA.

For example convention and guidance e.g. BSRIA require a series of traverse readings to be taken to obtain a correction factor for any given make, model and size of diffuser or grille. Some hoods or balometers are provided with a flap to enable the instrument estimate the resistance of the hood often known as "back pressure compensation". Many instrument manufacturers state this is acceptable for proportional balancing (where accuracy is not important) or where the measurements are not needed for their accuracy, then the manufacturer, states for accurate measurements e.g. healthcare, correction factors must be obtained.
Note there are many ways to obtain compliant (with for example BSRIA) traverse readings <0.3m after a bend or air disturbance.

See other guidance note.

14 Room differential pressures

A record of the air flow measurements of the whole system (supply and extract), how they were undertaken and to which standard e.g. BSRIA.

15 Air change rates

A record of the air change rates for each room where the designer has stated them or the HTM or HBNs state them for the whole system (supply and extract), how they were undertaken and to which standard e.g. HBN 20

16 Supply air volumes

These to be recorded for each room served by the system.

Also see “air flow measurements”.

Also see section 6.

17 Extract air volumes

These to be recorded for each room served by the system.

Also see “air flow measurements”.

Also see section 6.

18 Air velocities

These should be recorded for both UCV theatres, Conventional Theatres and other areas including fume extract cabinets etc.

Also see section "UCV Canopy Test sheets".

19 Traverse Report

A record of duct volume flow rates and main branch ducts and the main duct as earlier record the method of measurement and standard applicable e.g. BSRIA.

20 Noise Levels

Record these for all rooms.

Also see section 6.
21. Duct cleanliness

Record locations where these tests were carried out.

These could be shown on the drawings/schematic as this is a more accurate method of location.

Suggest these are carried out in more locations where the result are close to exceeding the limits.

Also see section 6.

22. Particle Count and DOP tests

These tests often not required annually (only required annually when employer/client specifically requests this).

Where these tests are carried out, the report is to clearly state if the upstream concentration cannot be measured, in this case the test should not be completed, and remedial action recommended.

Also see Report conclusions & recommendations later.

Also see section 6.

23. UCV Canopy Test sheets

These to be recorded along with the temperature and humidity as the HTM, these also only to be carried out providing the temperature and humidity are as required by HTM 03-01 Part A, before and throughout the test.

Also see section 6.

24. Summary of defects & Action plans

This is a list of non compliances with the statutory requirements, guidance and standards, also see section 6.

This would also include the workplace regulations, control of substances hazardous to health regulations for example. It would be common for there to be others.

Also record any other health and safety defects or dangers to self or others as required by the Health and Safety at Work Act 1974.

As with any serious defect, the verifier should inform both their line manager and or client immediately on discovery (and record this in the report and likely in exec summary).

25. Energy saving recommendations

Not specifically required in the HTM, verifiers with the appropriate training should find suggestions/recommendations regard energy saving/sustainability very easy, also demonstrates depth of knowledge.
26 Report conclusions & recommendations

A clear set of conclusions and recommendations referencing back to the information provided, observations, tests and measurements carried out.

Also report if ANY information was not provided or available these might include:

- ductwork drawings,
- duct schematic,
- plans of AHU (including extract),
- plans of area served by ventilation system (not just the department),
- Plans showing location, type and rating of fire and or fire/smoke dampers,

Generally if any of the above (or other information was not available or not recorded on site) then the verifier cannot conclude the ventilation system is compliant and or safe e.g. without knowing where the ducts run etc. etc.

The conclusion and recommendation would have to be "provide or obtain" the information and either carry out another verification or amend the report and reissue it, recording the additional information.

Appendices

27 Equipment Calibration Certificates

Scanned certificates of calibration, to demonstrate the calibrations are in date and the instruments used have been calibrated at the values recorded in the verification report and meet the accuracy required by for example the HTM.

28 Knowledge base including training certificates

Demonstrating the people that worked on the system had the appropriate knowledge as required by HTM 00 clause 6.1 and HTM 03-01 Part B clause 3.2.

Other information may be added, to make the report more informative to the reader and meet the objective of a safely operating ventilation system.

Explanatory note.

As with any guidance, any one is free to take any other course of action, providing they can demonstrate that the action is equal or better than for example this guidance note.
6. Verification Requirements

The following details many of the measurements, tests and inspections required, these should be incorporated into all Verification works carried out and reports.

Ventilation systems - minimum requirements (annual inspections)

1 General requirements

Is there safe access when carrying out routine service and maintenance activities?

Is there an L8 risk assessment for the system?

Are there any risks associated with Legionella and other potential hazardous Organisms?

Is the system fit for purpose?

2 Location and access

Is the area around an AHU within a building is it tanked/bunded to prevent water penetration to adjacent areas, and adequately drained?

Are fire precautions in accordance with Firecode?

Is combustion equipment located in a fire compartment that houses air-handling equipment?

Are plant rooms that house AHUs used for general storage?

Combustible material should not kept in the plantroom?

3 Basic requirements

Does the plant contain any material or substance that could support the growth of microorganisms?

Does the plant contain any material or substance that could cause or support combustion?

Is access to items that require routine service, such as filters, fog coils and chiller batteries, via hinged doors?

Are items requiring infrequent access such as attenuators accessed via clipped or bolted-on lift-off panels?

Are all doors and panels close-fitting and without leaks?

Is access available via fixed ladders and platforms or pulpit-style movable steps?

Do electrical and mechanical services restrict or impede access to those parts of the AHU that require inspection?

Are viewing ports fitted in order to inspect filters and drainage trays?
Is internal illumination provided by fittings to at least IP55 rating?

Are fittings positioned so that they provide both illumination for inspection and task lighting?

4 AHU intakes and discharges

Are air intakes and discharge points located at high level, to minimise the risks of noise nuisance to surrounding buildings, contamination and vandalism?

Are intakes and discharges located so that wind speed and direction have a minimal effect on the plant throughput?

Are helicopter landing pads in the vicinity of ventilation intakes and discharges does this result in large short-term pressure changes?

Can exhaust fumes from a helicopter be drawn into intakes?

Are intake points situated away from cooling towers, boiler flues, vents from oil storage tanks, fume cupboards and other discharges of contaminated air, vapours and gases, and places where vehicle exhaust gases may be drawn in?

Are intakes sited at or near ground level, the area around them paved or concreted to prevent soil or vegetation being drawn in?

Are the intakes caged or located within a compound to prevent rubbish being left in the vicinity?

Is the protected area large enough to prevent vehicle exhausts entering the intake?

Is the discharge from a general extract system located so that vitiated air cannot be drawn back into the supply-air intake or any other fresh-air inlet. Is, the extract discharge located on a different face of the building from the supply intake(s)?

Is, there a minimum separation of 4 m between (any inlet or discharge), with the discharge mounted at a higher level than the intake?

Are discharges from LEV systems vertical and not less than 3 m above roof level?

Is the LEV discharge fitted with a cowl that could cause the discharge to be deflected downwards?

Are intake and discharge points fitted with corrosion-resistant weatherproof louvres or cowls to protect the system from driving rain (BS EN 13030, Class B)?

Are louvres operating with a maximum face velocity of < 2 m/s in order to prevent excessive noise generation and pressure loss and water ingress?

Is each intake and discharge point fitted with corrosion-resistant weatherproof louvres or cowls to protect the system from driving rain?

Inside of the louvres is there 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?

Is the duct behind a louvre self-draining. If this is not practicable, or tanked and provided with a drainage system?
Is cleaning access provided either from the outside via hinged louvres or by access doors in the plenum behind the louvre?  
(Where a common plenum is provided, cleaning access should be via a walk-in door.)

5  Fan drives

Are fan-drive trains, whether supply or extract, for weatherproof units designed to be located outside, the fan drive enclosed?

Are fan-drive trains easily visible through a viewing port with internal illumination accessed via a lockable, hinged door?

Are the motor windings of induction-drive "plug" motor arrangements and in-line axial fans having a pod motor within the air stream protected from over-temperature by a thermistor and lockout relay?

If the computer control system or its software develop a fault – can the fan can be switched to a direct start with fixed speed and manual operation?  
(critical care systems serving operating suites, high dependency care units of any type, isolation facilities, laboratories and pharmaceutical production suites.)

6  Heater-batteries

Is access for cleaning provided to both sides of all fog coils and heater-batteries?

Where auxiliary wet heater-batteries are located in false ceilings, are they fitted with a catch tray and leak alarm?

Is the auxiliary wet heater-batteries catch tray installed under both the battery and the control valve assembly to protect the ceiling from leaks?

Is a moisture sensor and alarm fitted to the auxiliary wet heater-batteries drip tray?

7  Cooling coils

Are all cooling coils – whether with the AHU or with a branch duct – fitted with their own independent drainage system as specified in HTM?

For all cooling coils is there a baffle or similar device provided in the drip-tray to prevent air bypassing the coil?

Is the drip tray large enough to capture the moisture from the eliminator, bends and headers?

Does the cooling-coil control valve close upon selection of low speed, system shut-down, low air flow and fan failure?

Are auxiliary wet-cooling coils located in false ceilings, fitted with a catch tray and leak alarm?

Are the auxiliary wet-cooling coils catch trays installed under both the battery and the control valve assembly to protect the ceiling from leaks?

Are the auxiliary wet-cooling coils provided with a moisture sensor and alarm should be fitted in the tray.
8 Humidifiers

Where humidifiers are not in use has all associated pipework should also been isolated at its junction with the running main?

Are humidifiers operating safely and are not a source of contamination?

9 General requirements

Does the humidifier create complete mixing of the steam with the air?

Have the humidifier manufacturers’ instructions been closely followed regarding minimum distances, which should be allowed before bends or other components including filter mounted downstream?
(If it becomes saturated by the humidifier, organisms can grow through the filter and be released into the duct. These may then be carried on the air stream into an occupied space.)

Are hinged access doors with viewing ports and internal illumination should be provided to the humidifier?

Is a label warning that the device emits live steam and should be isolated prior to opening affixed to the access doors to the humidifier.

Are all parts of the humidifier and its associated ductwork in contact with moisture manufactured from corrosion-resistant materials; stainless steel is preferred?

Are the electrodes of self-generating electrode-boiler humidifiers stainless steel?

Is the water supply for the humidifier derived from a potable source?

Chemical treatments must not be added to the water supply to humidifier units.

Is there provision for draining down supply pipework and break tanks serving self generating humidifiers during the seasons when they are not required in service?

Is there isolation of the water supply at its junction with the “running” main to prevent the creation of a dead leg?

Are all parts of the humidifier water supply system capable of being cleaned and/or disinfected?

10 Acceptable types

Are Water-curtain, spray or mist humidifiers of any type fitted? (they should not be used.)

Is the introduction of steam, by an appliance specifically designed to discharge dry steam into the air-conditioning system without objectionable noise or carry-over of moisture?

11 Selection

Is the humidifier operating at a pressure of approximately 1 bar?

Is the Humidifier supply pipework provided with a dirt pocket, pressure-reducing valve and steam trap installed as close as practicable to the humidifier so that the steam condition at entry is as dry as possible?
Is a temperature switch on the condensate line (or equivalent design provision by the humidifier manufacturer) incorporated to prevent “spitting” on start-up?

Mains steam humidifiers is there any back-pressure in the condensate discharge line, which will result in flooding into the duct?

Some steam generators incorporate a heated tank that requires regular cleaning and descaling. Does this allow the steam-supply manifold to be physically isolated from the air duct in order to prevent contamination of the air stream by cleaning agents while this is taking place?

12 Location

Is the humidifier lance located to prevent the steam impinging onto the side(s) of the duct, condensing and generating excess moisture?

13 Control

Accurate humidity control can only be provided on single-zone systems or multi-zone systems with zonal humidifiers. Do the humidity sensors control the humidifier for low-level humidity control and override the temperature controls to open the cooling-coil valve for high-level humidity control?

In multi-zone humidification systems is a minimum humidity sensor located in the supply duct(s) following the last heater-battery?

Do overriding controls separate from the normal plant humidistat and prevent excessive condensation in the conditioned space when starting up?

Is a time delay incorporated into the humidifier control system such that the humidifier does not start until 30 minutes after the ventilation/plant start-up?

Is a high-limit humidistat installed to limit the output of the humidifier so that the saturation in the duct does not exceed 70%?

Does this humidistat control the added moisture? (It is not necessary to install a dehumidifier to reduce the humidity of the incoming air if it already exceeds 70%.)

Does the humidifier control system ensure that the humidifier is switched off when the fan is not running?

Does the control isolate the humidifier upon selection of set-back operation and in addition, on system shutdown, low air flow or fan failure, does the humidifier be isolate?

For where a water-supplied local steam generator is unused for a period exceeding 48 hours, does it automatically self-drain (that is, all water content must drain out – including that contained in the supply pipework – all the way back to the running main) and remain empty?

Are hinged access doors with viewing ports and internal illumination provided?

Steam generators of a type that requires regular cleaning and descaling. Can the installation be physically isolated from the air duct in order to prevent contamination of the air supply by cleaning agents?
14 Humidity control methods and application

For certain types of steam humidifier, it may be necessary to install a thermostat in the condensate line from the humidifier’s steam supply, to ensure that the steam at the control valve is as dry as possible before it is injected into the air supply, is this fitted and working?

Does the humidifier control system ensure that it is switched off with the fan?

Does the control system ensure the humidifier is isolated for an adequate time before the fan is turned off so as to purge humid air from the system?

Do all control valves fail-safe (that is, close in the event of power failure), and the humidifier be interlocked with the low air-flow switch?

15 Filtration

Are mounting frames designed so that the air flow pushes the filter into its housing to help minimise air bypass?

Are all filters should be of the dry type? Are pre-filters positioned on the inlet side of the supply fan, downstream of the frost coil?

Are secondary filters on the positive-pressure side of the fan?

Does the filter installation provide easy access to filter media for cleaning, removal or replacement?

Are hinged access doors provided?

Is the upstream side of the filter visible for inspection through a viewing port with internal illumination?

Are all filters provided with a means of checking the differential pressure across them? (Direct-reading dial-type gauges marked with clean and dirty sectors are preferred.)

16 High-efficiency filters – HEPA and ULPA

Are 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.)

Are HEPA filters used in extract systems for the containment of hazardous substances or organisms. (They may be fitted with pre-filters to extend their service life.)

And does, the installation incorporate provision for the subsequent safe removal and handling of contaminated filters by maintenance staff?
17 Energy recovery

For energy recovery, is cleaning access to both sides of the device?

Are energy recovery devices fitted, on the extract side protected by a G3 filter?

Are energy recovery devices provided with a drainage system to remove Condensate?

Is the heat-recovery device controlled in sequence with the main heater-battery?

Does the heat recovery incorporate a control to prevent the transfer of unwanted heat when the air-on condition rises above the plant’s required set-point?

18 Attenuation

Is cleaning access provided at both ends of any attenuator unit?

19 Identification and labelling

Are all supply and extract ventilation systems clearly labelled? (The label should identify both the AHU and the area that it serves. The lettering should be at least 50 mm high and be mounted in an easily visible place near the fan of the unit.)

Are all subsystems and the principal branch ducts similarly labelled? (The label should identify both the AHU and the area that it serves. The lettering should be at least 50 mm high and be mounted in an easily visible place near the fan of the unit.)

Is the direction of air flow clearly marked on all main and branch ducts?

Are all air-flow test-points clearly identified, and the size of the duct given?

20 Pressure stabilisers

Are Pressure stabilisers unobstructed and silent in operation?

21 Annual verification

a. the system is still required;

b. the AHU conforms to the minimum standard (see Chapter 3);

c. the fire containment has not been breached;

d. the general condition of the ventilation system is adequate;

Is the system overall operating in a satisfactory manner?

The fabric of the area served is satisfactory?

The system performance is adequate with respect to the functional requirement?
22 Fabric of the area served

Are all service penetrations and access panels should be sealed to prevent uncontrolled air flow between rooms and service voids?

Is equipment and stock items obstructing low-level supply, transfer or extract air-flow paths?

Have all fire dampers should be tested as part of the annual verification?

Have LEV systems been subject to an examination?

23 Inspection General

Have the inspection activities should be 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?

24 Inspection of critical systems

Was a permit-to-work completed to ensure that taking the ventilation system out of service did not compromise the activities of the user department?

25 AHU drainage

What is the cleanliness of the drainage trays and colour of the water in the trap? (as Table 3)

26 Filter changing

Were workmen handling, Dirty extract-and-return air filters that may pose an increased level of hazard protected?

Have dirty filters been removed from the plantroom?

Are filters fitted the right way round?

Have bag filters been fitted with the pockets vertical. Have any transit tapes been removed and individual pockets are separate and free to inflate?

27 Changing extract filters containing hazardous substances

Were filters removed from an extract system for the containment of hazardous substances or organisms. Was this be achieved by:

a. sealing the hazardous substance into the filter before it is removed;
b. a system to fumigate the filter to kill any organisms;
c. 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.

Did the method of filter removal/replacement chosen should reflect the nature of the hazard?
28 Ventilation system cleaning

Has the intake section of a ventilation system been vacuumed-out as necessary to remove visible particles?

Has the AHUs been vacuumed-out and/or washed down internally as necessary to remove obvious dust and dirt?

Extract air systems handle unfiltered air. Do they need to be cleaned as frequently as necessary in order to maintain their operating efficiency?
(Note Room extract terminals, particularly those sited at low level in critical care areas, will need regular cleaning.)

Is there any evidence of chemical cleaning of the AHU or ductwork systems?

Have hatches been checked to ensure that they have been correctly replaced and do not leak?

29 Chilled beams

The efficiency of these chilled beams will rapidly decline if they become blocked with fluff/lint. Have they been inspected every six months and do they need to be cleaned as appropriate?

30 Split and cassette air-conditioning units

These split and cassette air-conditioning units incorporate internal recirculation air filters and a drainage system to remove condensate from the cooling coil. Do these systems need cleaning?

31 General

Is the system still required?

Why was it installed?

Is that function still required?

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)
Is the air distribution system satisfactory?

- Access
- Fire dampers
- Cleanliness
- Insulation
- Identification
- Room terminals
- Pressure stabilisers

Inspect to ascertain continued fitness for purpose

Does the measured system performance still accord with the design intent and achieve a minimum acceptable standard?

- Design air velocities
- Design air-flow rates
- Room air-change rates
- Pressure differentials
- Noise levels
- Air quality

Establish the design values Measure the system output to verify its performance

Does the control system function correctly?

- Desired environmental conditions
- Control sequence logic
- Run; set-back; off philosophy

Establish the design requirement Inspect/test to verify performance

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!

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
32 Specific AHU Questions

Record location of Plantroom, Air-handling unit Age, Area served, Date of survey and Name.

Record the General condition as End useful life, Poor, Average or Good

Record Compliance with minimum standards as Poor, Average or Good

Record Maintenance quality as Poor, Average or Good

Questions

Is the unit and its associated plant secure from unauthorised access?

Is the unit safely accessible for inspection and maintenance?

Is the air intake positioned to avoid short circuiting with extract or foul air from other sources such as gas scavenging outlets? (also see other items)

Are all inspection lights operating?

Are motorised dampers fitted to the intake and discharge? Are fan motor(s) outside of the air stream?

Is the fan drive train visible without removing covers?

Is the cooling coil located on the discharge side of the fan Is an energy-recovery system fitted (state type)

If so 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? Are drainage traps clean and filled with water? (see table 3 in HTM 03-01 part B)

Is the drain trap air break at least 15mm

If a humidifier is fitted, state the type

If fitted Is the humidifier capable of operation?

Is there space to safely change the filters?

Are there test holes in the principal ducts?

Are the test holes capped?

What is the general condition of the exterior of the AHU?

Are the principal ducts lagged?

What is the general condition of the associated control valves and pipework?

Is the pipework adequately lagged?

Is the system clearly labelled?

Record pre-filter differential pressure

Record main filter differential pressure
Did the motorised dampers close on plant shut-down?

Is the vermin/insect screen clean?

Is the intake section including the fog coil clean?

Are the prefilters correctly fitted with no air bypass?

Are all drive belts correctly aligned and tensioned?

Is the cooling-coil matrix clean?

Are all drip-trays fully accessible or capable of being removed for cleaning and have a fall to drain

Are the drainage trays stainless?

Are the drainage trays clean?

Are there any signs of water ponding in the AHU?

Is the matrix clean for each heater-battery?

Have the main filters been correctly fitted with no air bypass?

Is AHU and its associated main ductwork clean internally?

Did unit restart satisfactorily?

Did fan motors automatic change-over operate satisfactorily (if fitted)?

33 Specific questions for other parts of the ventilation system, and areas served by the ventilation system

Assessment of compliance with Health Building Note 26 and Health Technical Memorandum 03-01 or critical ventilation system HBN and or HTM03, Assessment and actions required, split into one of three categories:

Urgent management action required,
Maintenance action required
or none

Maintenance quality, Assessment and actions required, split into one of three categories:

Urgent Management action required by estates/facilities department,
Maintenance action required
or none

Questions

Are windows hermetically sealed? (all areas served by ventilation system)
Are the ceilings in the theatre and prep room complete and sealed? (also applies to other high dependency medical locations)

Are there any significant faults in the fabric of the rooms in the suite? (all areas served by ventilation system)

Are room light fittings correctly sealed? (all areas served by ventilation system)

Do all doors close completely and hold against the room pressure? (all areas served by ventilation system)

Are the pressure stabilisers operating correctly and silently? (all areas served by ventilation system)

Are all supply and extract air terminals and pressure stabilisers visibly clean? (all areas served by ventilation system)

Measure and record the operating room temperature (all areas served by ventilation system)

Does this accord with that displayed on the surgeon’s panel? (also applies to other high dependency medical locations)

Measure and record the operating room relative humidity (all areas served by ventilation system)

Does this accord with that displayed on the surgeon’s panel (also applies to other high dependency medical locations)

Measure and record the supply and extract air flow in the principle ducts (all areas served by ventilation system)

Measure and record the air flow at all supply and extract terminals (all areas served by ventilation system)

Does the derived air-change rate achieve at least 75% of the design? (all areas served by ventilation system)

For UCV units, also measure and record the air velocities within the canopy using the method set out in Chapter 8 of Health Technical Memorandum 03-01 (Part A) (UCV theatres only)

Do the air velocities achieve the standard appropriate for the type of canopy? (UCV theatres only)

Measure and record the room differential pressures (all areas served by ventilation system)

Do the room differential pressures ensure a flow of air from the clean to the less clean areas? (all areas served by ventilation system provided with pressure/air flow cascade)

Measure and record the noise levels in the principal rooms of the suite (all areas served by ventilation system)

Do the noise levels fall below the limits set out in Table 2 of health Technical Memorandum 03-01, Part B? (all areas served by ventilation system)

Check the operation of all ventilation control functions represented on the surgeon’s panel. (also applies to other high dependency medical locations)

Do the indicators accurately represent the operational state of ventilation system(s)? (also applies to other high dependency medical locations)

For UCV systems: is the UCV and AHU interlocked to ensure that the AHU runs at full speed when the UCV is at operating speed or at set-back? (see Table 6 in Health Technical Memorandum 03-01, part A) (UCV theatres only)
With the UCV running at set-back, does the system maintain the standard of a conventional operating room? (UCV Theatres only)

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? (all ventilation systems with two speed/multi speed or set back ventilation)

7. **Cost impact statement**

Costs these are split into, capital, equipment, labour, maintenance, energy as follows:

Capital

Clearly £ Nil.

Equipment

£ Nil Less than £100, life 3+ years, also see next item, equipment should already be held by technician.

Labour

Additional 10 mins maximum, verifications are commonly carried out a high number of people carrying these works out claim this is their main work, so efficient working would be the norm. Cost based on £50 (£65) per hour, therefore £10(£13) per ventilation system.

Note of the companies that have incorporated these requirements have done so by the use of appropriate off the shelf software.
Maintenance

Significant savings with respect to cost of needles repair and replacement of ventilation plant components, most reasonable sized hospitals will replace one or more frost coils etc. per year. Also significant reduction in corrosion and reduction in opportunities for bacterial/mould colonisation.

Energy

These savings are significant with respect to cost for test, common for components operation to clash e.g. energy recovery device not working e.g. run around coil, energy recovery recuperator in bypass, when the plant needs heating......

8. Additional Resource or Equipment requirements

Temperature probe and humidity detector and straight edge for checking alignment of belts.

This already required to measure and record room environmental conditions e.g. theatre, ICU temperature and humidity, in this case equipment cost would be NIL.

Note to check the control functions the instrument is only required to measure the energy recovery device as the temperatures are low and the supply air condition by inserting the probe in a convenient supply diffuser all the other checks require no instruments.

In practice this equipment would commonly used and in the tool box of any technician, verifier, etc.

9. Current situation

As reasoned and discussed earlier in the document: All ventilation systems should be inspected annually to ensure conformity with minimum requirements, whilst there are many who offer these verification services, many do not inspect or report on all the areas of ventilation systems defined in HTM 03-01.

Plainly the poor compliance with these requirements will increase revenue expenditure, business and reputation risk, energy consumption and result in increased un planned failure unavailability of facilities.

10. Distribution

This document is intended for the use and reference of all including prospective readers, including:

- Authorised Persons,
- Senior Operational Managers,
- Verifiers,
- Directors of estates and facilities,
- Authorising Engineers,
- Competent Persons