

NEW GUIDELINE VDI 6022: HYGIENIC STANDARDS FOR VENTILATION AND AIR-CONDITIONING SYSTEMS

Dipl.-Ing. (FH) Lars Funk, VDI-Society for Building Services, Düsseldorf

ABSTRACT

The new Guideline VDI 6022 contains hygienic standards for ventilation and air-conditioning systems. The requirements for the planning, design, operation and maintenance of ventilation and air-conditioning systems and their components are dealt with to ensure a hygienic condition according to the state of the art. The Guideline is subdivided as follows:

part 1 Offices and assembly rooms	(published 07/98)
part 2 Standards for Hygiene training	(published 12/98 as a draft)
part 3 Factories	(activities have been started 01/99)

The Guideline is worked out in cooperation with experts of air-conditioning systems as well as hygienics and medics.

HYGIENIC REQUIREMENTS FOR AIR CONDITIONING SYSTEMS

Air-conditioning systems should create physiologically satisfactory room climate and hygienic indoor air. Air-conditioning systems are to be planned, designed, operated and maintained according to the state of the art so that they present no danger to health or disturbance to the ambience, and produce no thermal discomfort or odours.

On the basis of these general requirements for ventilation and air-conditioning systems follow special requirements for the planning, manufacture and installation as well as for operation and maintenance. These requirements are described in the following. It applies to ventilation and air-conditioning systems for offices, conference and other occupied rooms.

PLANNING, MANUFACTURE AND INSTALLATION

When planning air-conditioning systems, the type and position of the outside air intake must be such that the least polluted outside air is drawn in. The intake should be sufficiently far above surrounding surfaces to minimise the amount of impurities that can be drawn in from them. Short circuits between outgoing air and incoming outside air shall be precluded by having an adequate distance or other suitable technical measures. Effects from other emitters (e.g. cooling towers) shall be avoided by the choice of location of the outside air intake.

The complete air-conditioning system in the air-carrying area shall consist of materials which neither emit hazardous substances nor provide a nutrient medium for microorganisms. Interior acoustic or thermal lining shall consist of abrasion-proof material which is accessible for cleaning and harmless to health.

All air-carrying components shall be installed in a hygienic, i.e. clean, condition and be capable of inspecting, cleaning and, if necessary, disinfecting at reasonable technical cost.

After carrying out disinfection in the area of air-conditioning systems, it must be ensured before re-starting operation that no substances which are harmful to health or cause odours enter the inlet air.

Air filters shall be designed so that they can be installed, serviced and, if necessary, replaced in a manner which minimises, or at least does not increase, the introduction of airborne germs or inorganic or organic dusts. It shall be ensured that they themselves cannot become a source of airborne substances which are hazardous to health or cause odours.

On the basis of these requirements for the planning, manufacture and installation of ventilation and air-conditioning systems follow special requirements for each component of the system. In the Guideline these special requirements are described in detail for every component.

OPERATION AND MAINTENANCE

Air-conditioning systems shall also be operated and maintained in such a way that the hygienic requirements also are permanently complied with. Regular technical inspections and servicing as well as frequent hygiene checks by company personnel (own inspections) and additional hygiene inspections at greater intervals by trained personnel shall be carried out for this purpose. All checks shall be recorded.

Air-conditioning systems shall be regularly checked for contamination by the operator and cleaned as necessary by qualified personnel. A system can be regarded as clean if the air-carrying surfaces are completely clean and there are no damp sections.

Filters shall regularly be visually inspected and replaced, regardless of the actual service life if there is obvious contamination or leakage.¹

If air humidity is present, hygienically-safe operation shall be ensured by the operator by carrying out regular hygiene checks and cleaning, including sterilisation of the water-carrying and damp parts of the system as necessary. The total bacterial count (TS-Blut-Agar) in the humidifier water shall not exceed 1000 KBE/m² (at an incubation temperature of 20 °C ± 1 °C and 36 °C ± 1 °C). This check can be carried out using a quick test (so-called dip slides).

In the case of legionella, the total bacterial count shall not exceed 1/m^l. This check shall be carried out every two years as part of the hygiene inspection. Sterilisation can be carried out using either physical or chemical methods. Chemical disinfection may only be carried out using biocidal materials whose effectiveness and harmlessness have been proven under practical conditions. In the case of vapour humidification, the vapour shall contain no harmful substances. Regular hygiene inspections shall be performed as part of the servicing and cleaning of air-conditioning systems by specialist personnel using state-of-the-art testing. If necessary, hygienists are to be used. The regular hygiene inspections shall include the following.

¹ Investigations into contamination in air ducts is presently being carried out at the FU Berlin, Institut für Hygiene. In future it will be possible to stipulate a limit for the permissible contamination in air ducts in g/m², giving the test procedure.

² KBE: Colony forming units

- Walk-round inspection of the air-conditioning centre and the rooms supplied by it for obvious damage, accompanied by the authorised works doctor and personnel officer.
- Recording of physical climatic parameters (temperature, humidity, air speed) at representative points in the air-conditioning system and in rooms.
- Inspection of the hygiene condition including specific dab tests on filters, humidifiers and heat exchangers.
- Check of the total bacterial count of legionella.
- Written report to the operator on the results of the inspection together with recommendations of necessary and desirable hygiene measures where action is required.

The hygiene inspection of air-conditioning systems shall be carried out by specialists

- every two years in the case of systems with air humidification
- at intervals of three years for systems without air humidification.

On the basis of these requirements for operation and maintenance of ventilation and air-conditioning systems follow special requirements for each component of the system. In the Guideline these special requirements are described in detail for every component.

Control strategies

Air-conditioning systems shall be operated in such a way that microbiological growth on air filters is avoided as far as possible.

Humidifiers are to be controlled together with preheaters and afterheaters so that the relative air humidity in the system, particularly at air filters, does not exceed 90%.

The average relative humidity at air filters of the first stage shall not exceed 80% over three days.

If the stipulated limits are exceeded, the cause is to be determined at once and permanently rectified where possible.

To prevent damp areas being generated downstream of humidifiers or coolers during a planned shutdown, the humidifiers and coolers are to be shut down first and the air duct system is to be operated dry.

Air valves in the air duct system are to be closed to prevent wind or updraught forces blowing through the ventilation system.

QUALIFICATION AND TRAINING OF PERSONNEL

Permanent compliance with hygiene requirements and the performance of the operating and maintenance measures on air-conditioning systems needed for this purpose, requires suitably qualified personnel. Demanding operating tasks as part of servicing and also inspections and repair should be carried out by specialist personnel who have completed appropriate trade training (e.g. as plant or electromechanical technicians) or who have equivalent technical experience appropriate to their specialisation. Simple operating tasks such as checking, cleaning and certain servicing tasks (replacement of air filters) may be transferred to instructed personnel with no special trade training. Such personnel must be completely

familiar with the tasks and functions of ventilation and air-conditioning systems and their individual components.

An additional hygienic training is necessary regardless of the type of qualification of the personnel:

Hygienic training Category B: Training for simple hygiene tasks

Knowledge of the following has to be shown by personnel who carry out simple hygiene tasks and inspections on air-conditioning systems.

- (1) Necessity and significance of hygiene in the operation of air-conditioning systems.
- (2) Hygiene problems of the individual air-carrying equipment in air-conditioning systems.
- (3) Servicing of air-conditioning systems, influence variables for stipulating servicing intervals.
- (4) Simple measuring procedures for monitoring air-conditioning systems.
- (5) Procedures for substances which are hazardous to the environment, including their disposal.
- (6) Personal protection measures with respect to hygiene when carrying out operating and maintenance tasks.
- (7) Relevant regulations (particularly accident prevention regulations) and technical standards.
- (8) Handling chemical cleaning and disinfecting agents.

Hygienic training Category A: Training for demanding hygiene tasks

Additional knowledge in the field of hygiene is to be shown for demanding hygiene tasks and inspections on air-conditioning systems. In addition to that one required for category B, the following training is also required.

- (1) Basic principles of hygiene.
- (2) The hygiene significance of different air treatment processes.
- (3) Physical and chemical measuring procedures as well as hygiene-microbiological investigation methods.
- (4) Problem of the sick building syndrome (SBS), symptoms and possible causes.
- (5) Important technical developments and the practical opportunities which these afford.
- (6) Hygiene regulations and technical regulations for the operation of air-conditioning systems.

For the operation of ventilation and air-conditioning systems, training to category B is necessary. Furthermore the qualifications required by operators depends upon the size and technical complexity of the system as well as its use. Simple air-conditioning systems (e.g. those with only an air treatment function) can be operated by instructed personnel with no special trade training. More advanced, complex air-conditioning systems should be operated by technical personnel.

Maintenance (servicing, inspection, rectification) may only be carried out by personnel who have been instructed and trained for this purpose. An overview about the tasks which occur is shown in Fig. 1.

The VDI-Society for Building Services offers those trainings in cooperation with qualified partners in Germany. They also intend to offer those trainings abroad. Persons that are

interested in working together with the VDI-TGA concerning this matter are asked to contact the head office directly.

Maintenance		
Grouping of measures		
Inspection	Servicing	Repair
Objective of measures (definition as per DIN 31051)		
Identification and assessment of actual condition	Maintening of the desired condition	Restoration of the desired condition
Individual measures		
Testing Measuring Assessing	Testing Adjusting Replacing Supplementing Lubricating Preserving Cleaning Disinfecting	Rectification Replacement
Performed by		
Technician Engineer	Instructed personnel (limited use) Fitters Technicians	Fitters Technicians
Required training in hygiene		
Category A	Category B	Category B

Fig. 1 Maintenance, measures and personnel qualifications

The following people were involved in this Guideline: Dipl.-Ing. (FH) Peter Amend, Quierschied; Dr.-Ing. Falk Anders, Stuttgart; Dr. med. Elisabeth Arnold-Sundermann, Mainz; Dr. Wolfgang Bischof, Berlin; Dr. Johannes Blasius, Bonn; Dr.-Ing. Ulrich Finke, Berlin; Prof. Dr.-Ing. Klaus Fitzner, Berlin (stellv. Obmann); Dipl.-Ing. Karl Flaig, Stuttgart; Dipl.-Ing. (FH) Lars Funk, Düsseldorf (VDI-Geschäftsstelle); Dipl.-Ing. C. Händel, Stuttgart; Winfried Kappler, Helmstadt; Dr.-Ing. Achim Keune, Hamburg (Obmann); Dipl.-Ing. Jürgen Klaubert, Darmstadt; Dr. rer. nat. Andrea Koch, Erfurt; Prof. Dr. med. Kröling, München; Dr.-Ing. Boris Kruppa, Bonn; Dipl.-Ing. Rainer Kryschi, Kaarst; Dr.-Ing. B. Küter, Wiesbaden; Dipl.-Ing. Werner Lorenz, Frankfurt; Dipl.-Ing. Günther Mertz, Bietigheim-Bissingen; Dr.-Ing. Martin Möritz, Berlin; Dr. rer. nat. Elke Roßkamp, Berlin; Prof. Dr. med. Martin Schata, Düsseldorf; Prof. Dr.-Ing. Ernst-Rudolf Schramek, Dortmund; Dipl.-Ing. Schroers, Neukirchen-Vlyun; Prof. Dr. B. Seifert, Berlin; Dr.-Ing. Frank Sodec, Aachen; Dipl.-Ing. Undine Stricker-Berghoff, Düsseldorf (VDI-Geschäftsstelle); Prof. Dr. med. Uwe Thielebeule, Karlsruhe; Dipl.-Ing. Bernd Tietze, Leverkusen; Dipl.-Ing. Hilmar Weiss, St. Ingbert