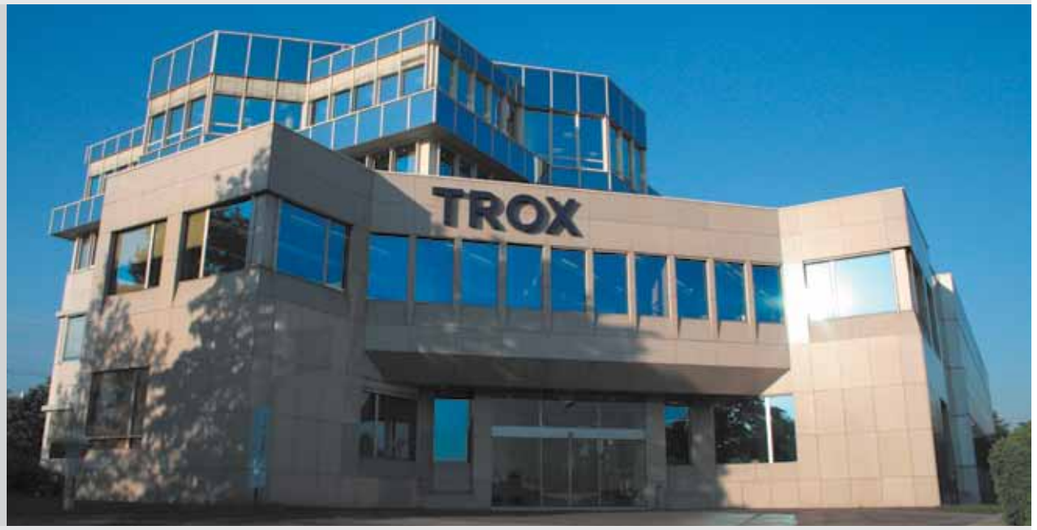
▶ Healthy climate ▶▶

More safety and comfort in hospitals and other highly sensitive areas

TROX® TECHNIK
The art of handling air



▸The art of handling air ▸▸

TROX understands the art of competently handling air like no other company. Since its foundation in 1951, TROX has been developing and manufacturing sophisticated components, units and systems for ventilation and air conditioning as well as for fire protection and smoke control. Dedicated research and development have made TROX a leader of innovation in these fields.

Demand-based solutions.
Working closely with its customers, TROX develops bespoke and demand-based systems that take the relevant criteria for each building into account and meet the requirements of its occupants. This close cooperation leads to sustainable solutions that help to increase people's well-being and to protect life and the environment. In hospitals, it is of paramount importance to create the best possible conditions with regard to room air quality, safety and hygiene – for patients, staff and visitors.

▸Perfect system ▸▸

Complete solutions: All air conditioning products from a single source.
From fans and air handling units to efficient filters, and from air terminal devices and air-water systems to intelligent control components: the TROX portfolio comprises the entire spectrum of ventilation and air conditioning components, units and systems. TROX can hence provide complete solutions for hospitals.

Components, units and systems from a single source are a clear advantage as they reduce the design and coordination effort considerably.

Stringent conditions for hygiene and safety.
In the highly sensitive areas of health care, more than anywhere else, ventilation and air conditioning systems must meet particularly critical hygiene and safety requirements:

- Minimise the level of airborne bacterial contaminants, particularly in protection zones (operating theatre, instrument trolley, lab)
- Ensure the necessary air change and maintain stringent room air conditions (differential pressure, temperature and humidity)
- Limit the concentration of contaminants in the occupied zone
- Prevent the spread of fire by means of fire dampers
- Prevent the spread of smoke by means of a powered smoke exhaust system

Federal Research and Clinical Centre of Paediatrics, Moscow, Russia

Centre Hospitalier Universitaire Pontchaillou, Rennes, France

Essen-Süd Hospitals, Essen, Germany

► Healthy and controlled climate ►►

Hospitals have special requirements on the equipment and performance of ventilation and air conditioning systems. Room air contamination must be minimal at all times, and critical limits must not be exceeded at any time. Moreover, dust, waste anaesthetic gases and odorous substances must be contained and removed by a suitable air conditioning system. This applies in particular to operating theatres, intensive care units, delivery rooms and neonatal units.

Intelligent air management systems make sure that everything is under control. Hygiene and safety are the overriding factors, yet energy efficiency should not be neglected. TROX has long been committed to the development of adaptable system solutions that are highly efficient and help not only to save resources but also to reduce system operating costs.

Innovative, widely proven technology from TROX can be found in many large and well-known hospitals all over the world. This is not surprising since TROX products meet the most demanding requirements of hygiene and safety.

Hamburg-Eppendorf University Hospital, Hamburg, Germany

Oncological Children's Hospital, Athens, Greece

▶ Economic aspects of ventilation in hospitals ▶▶

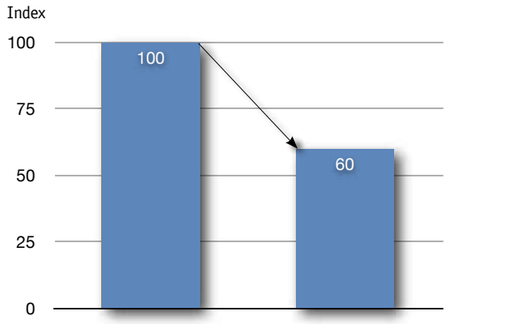
Suitable ventilation and air conditioning systems not only help patients to recuperate more quickly but, as studies have shown, also increase staff performance, and this is something the management of any hospital will strive for.

Cost reform in the health care sector: increasing the efficiency.
Effective ventilation and air conditioning components are a given, yet we also keep a close eye on their efficiency since hospitals are under enormous and ever increasing pressure to save costs. Replacing or modernising older equipment may well lead to a noticeable reduction of system operating costs. The consumption of electrical energy in hospitals amounts nowadays to 20 % of their total energy consumption, and to 50 % of their energy costs.

These costs are primarily caused by outdated ventilation and air conditioning systems which is why measures to increase their energy efficiency may indeed result in huge savings. Investments into state-of-the-art ventilation and air conditioning equipment pay usually off within a few years: with energy savings of up to 40 %.

Another incentive to not postpone energy efficient refurbishments is the EC directive on energy end use efficiency and energy services. According to the directive, Germany should reduce its energy use by 9 % within the next few years, i.e. by 2016. And the public authorities are committed to lead the way.

This application brochure not only gives you an overview of specific TROX solutions for the health care sector but offers practical design advice with regard to the ventilation and air conditioning in hospitals.



Energy savings due to the modernisation of air conditioning systems

Oncological Children's Hospital, Athens, Greece

▸ Complex requirements of healthy room air ▸▸

Selecting and designing a ventilation and air conditioning system for a hospital is one of the most challenging and complex tasks for building services engineers. It is also a particularly appealing task for everyone involved: for specialist consultants and HVAC contractors as much as for component manufacturers. A task that requires a maximum of experience, skills and technical know-how, and close cooperation with doctors and hygiene specialists.

The table on the fold-out page informs you about the most important factors that should be considered when selecting and designing ventilation and air conditioning systems in health care.

For such a complex task we can obviously only give you a rough idea or recommendation for the best possible airflow and control system or product. Project-specific requirements must be dealt with individually.

TROX components, units and systems in a hospital:

1. Air handling units
2. Operating theatre ceiling with high-efficiency particulate filter
3. Particulate filter air terminal devices
4. Fire dampers with TROXNETCOM
5. Volume flow controllers with EASYLAB
6. Swirl diffusers
7. Volume flow controllers
8. Jet nozzles
9. Ventilation grilles
10. Disc valves (extract air)
11. Circular silencers
12. Fire dampers (KU-K30) with diffuser
13. Multileaf dampers
14. Smoke extract dampers
15. Smoke exhaust fans
16. X-FANS smoke exhaust fans for roof installation
17. X-FANS impulse jet fans

Important standards and guidelines relating to ventilation and air conditioning

EN 779 Particulate air filters for general ventilation (filtration efficiency)
EN 1822 (all parts) Particulate filters (HEPA and ULPA)
EN 13779 Ventilation for non-residential buildings – Performance requirements for ventilation and room-conditioning systems
ISO 14644-3 Clean rooms and related clean room areas – test methods
VDI 6022 Part 1 Hygiene requirements on air handling units and systems
DIN 1946-4 Ventilation and air conditioning in health care
SWKI Guideline 99-3 Heating and air conditioning systems in hospital buildings
ANSI/ASHRAE Standard 170 Ventilation of health care facilities

This table provides only an overview to help you select and design ventilation and air conditioning systems for the health care sector; it cannot cover all eventualities in this complex field. Project-specific requirements must be dealt with individually.

Design criteria	Protection areas															In-patient wards		Public areas			Operating range		
	Room class Ia				Room class Ib								Room class II											
Typical values for the most critical parameters in selected hospital areas, based on: EN 15251, DIN 1946-4, DGKH (German Society for Hospital Hygiene), SGSH (Swiss Society for Hospital Hygiene), ÖGHMP (Austrian Society for Hygiene, Microbiology and Preventive Medicine), and the commission for ventilation and air conditioning systems.	Operating theatres	AirLocks	Security areas/ Instrument prep.	Corridors	Surgery rooms	Consultation rooms	Minor surgery	Wound care	Corridors	Labs	Pharmacy	Isolation wards septic/antiseptic	Consultation rooms	Surgery rooms/ Minor surgery Wound care	Recovery room	Patient rooms	Nurse station	Waiting areas/ Reception	Cafeteria	Corridors	Administration[4] Single or open plan offices	Kitchen	Storage area/ Technical equipment rooms
Fresh air flow rate [$m^3/(h\ _{person})$]	800 – 1200 m^3/h	*	50 $m^3(h\ _{person})$							25 $m^3(h\ m^2)$		50 $m^3/(h\ _{person})$			150 – 200 $m^3/(h\ _{person})$	50 $m^3/(h\ _{person})$	> 25 $m^3/(h\ _{person})$	> 25 $m^3/(h\ _{person})$	> 25 $m^3/(h\ _{person})$		40/60 $m^3/(h\ _{person})$		
Fresh air flow rate [$l/(s\ _{person})$]	222 – 333 l/s	*	14 $l/(s\ _{person})$							7 $l/(s\ m^2)$		14 $l/(s\ _{person})$			42 – 56 $l/(s\ _{person})$	14 $l/(s\ _{person})$	> 7 $l/(s\ _{person})$	> 7 $l/(s\ _{person})$	> 7 $l/(s\ _{person})$		11/17 $l/(s\ _{person})$		
Design values for room temperature [°C]																							
Typical minimum room temperature when heating (winter)	18 – 26 possibly 27[2]				18 – 26					25		22 – 24	18 – 24			22 – 24		20			20	UB	
Typical maximum room temperature when cooling (summer)										25		25 – 26				25 – 26	25				26	UB	
Sound pressure level [dB(A)]																							
Typical range	30 – 48				35 – 45					35 – 50		35 - 45	35 – 45			25 – 40, day 20 – 35, night		35 – 45	35 – 50	35 – 45	30 – 40	40 – 60	
Standard design value	40				40					45		40	40			35, day/30, night		40	45	45	35	55	
Control strategy																							
Room pressure control (volume flow rate/pressure cascade)	●	●	●	●	o		o		o	o	●	●											
Room balancing functions		o	o	o	●	●	●	●	●	●	o	o	●	●	●								
Temperature control, day/night switching, CO_2 sensors	o				o						o					●	●	●	●	●	●	o	
Integration with BMS	●	●	●	●	●	●	●	●	●	●	●	●		●									
Volume flow controllers, supply and extract air																							
LABCONTROL – variable air volume controllers, quick-response control loops, static transducers	●	●	●	o	●	o	●	●	o	●	●	●		o									
Variable air volume controllers, standard construction, supply air only, slow-response control loops, dynamic transducers	o	o	o	o	o	●	o	o	●	o	o	o	●	o	●	o	o	●	●	o	o	●	
Variable air volume controllers, standard construction, extract air, slow-response control loops, static transducers	o	o	o	o	o	●	o	o	●	o	o	o	●	o	●	o	o	●	●	o	o	●	
CAV controllers				o					o							o	o			o	o		●
Type of ventilation																							
Mixed flow		●		●	●	●	●	●	●	●	●	o	●	●	●	●	●	●	●	●	●	●	●
Displacement flow (supply air discharge usually near floor)	o		o		o	o	o	o		o		o	o	o	o	o	o	o	o		o	o	
Inducing displacement flow																o	o				o		
Laminar flow	●		o		o	o	o	o			o	o											
Displacement flow			o		o	o	o	o			o	o											
Air terminal devices																							
Ventilation grilles																o	o	o	o	o	o	o	●
Swirl diffusers		●		●	o	o	o	o	●	o	o	o	●	●	●	o	●	●	●	●	●	o	●
Slot diffusers																o	o	o	o	o	o		
Displacement flow diffusers	o		o		o	o	o	o		o		o	o	o	o	o	o	o	o	o	o	o	
Profile Controlled Diffuser (PROCONDIF)			o		●	●	●	●		●	●	o										●	
Laminar flow diffusers	●		o								o												
Ventilation system																							
Air-water systems[3]																		●	●		●		o
Centralised ventilation system/All air system	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Filter stages																							
Ceiling mounted particulate filter		o[1]	o[1]		o[1]	o[1]	o[1]	o[1]	●[1]	o[1]	o[1]	o[1]	o[1]	o[1]									
Coarse dust filter M5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Fine dust filter F9	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Particulate filter H13/H14	●	●	●	●	●	●	●	●	●	●	●	●											

● Recommended o Recommended for some situations UB Usage-based [1] Select air terminal device. [2] Paediatric surgery. [3] Depending on locally applicable standards and guidelines. [4] DIN 1946. * Depending on room pressure.

▸ Recommended by leading hospital hygiene specialists ▸▸

TROX products for sensitive areas can be found in hospitals in many countries – well-known for their high standards of hygiene, reliability and proven safety.

Follow us on a walk through the various functional areas of a hospital. You will find TROX products for all the different departments of a hospital. This can obviously only be an excerpt from the extensive spectrum of innovative ventilation and air conditioning solutions that TROX offers for the health care sector.

Hamburg-Eppendorf University Hospital, Hamburg, Germany

Hospital Unimed Belo Horizonte, Brazil

The Royal Children's Hospital, Melbourne, Australia

Sana Hospitals, Düsseldorf, Germany

Evangelical Hospital, Wesel, Germany

Medisch Spectrum Twente (MZT), Enschede, Netherlands

Air cleanliness

Safe hygiene practice in aseptic areas.

The most critical requirements apply to the air in operating theatres. To prevent infections caused by airborne pathogens, and to ensure that standards of occupational medicine are adhered to, airflow and air filtration play a vital role.

▸ Operating theatre – low-turbulence laminar flow ▸▸

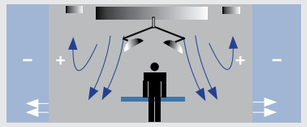
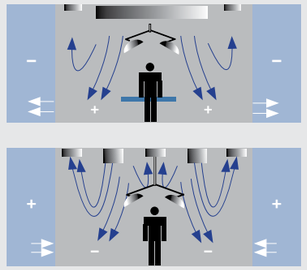
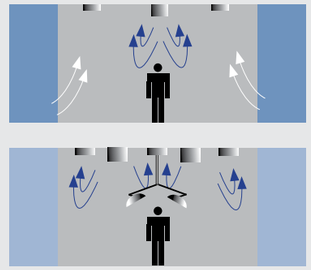
Ensuring aseptic conditions.
In operating theatres as well as in pre op and post op units, such as labs and ICUs, ventilation and air conditioning systems are indispensable. Ventilation and air conditioning systems must ensure that the protection area near the operating table and the instrument trolley are dynamically shielded. Filtered and conditioned ultra clean air reduces the number of airborne micro-organisms and consequently lowers the risk of wound contamination.

Laminar flow causing very little turbulence.
A constant laminar flow ensures that the air above the protection area, which has been 'contaminated' by the patient and the surgical team, is displaced. Operating theatres must only be accessed via airlocks; positive pressure must be maintained such that no pathogens from adjoining areas can enter. The way to maintain the pressure conditions in the operating theatre is a laminar flow that causes very little turbulence.

Low-turbulence laminar flow in the protection zone.

Discharge velocity	at least 0.23 m/s
Supply air differential	0.5 to 3 K
Protection area	usually 3.2 x 3.2 m
Volume flow rate	at least 8500 m³/h
Fresh air flow rate	at least 1200 m³/h
3-stage filtration	at least M5/F9/H13
Sound pressure level	max. 45 dB(A)

Rooms used for medical treatment are categorised according to the requirements of sterility (room classes Ia, Ib, II).

Room class Ia	Room class Ib	Room class II
Very high hygiene requirements: Transplant surgery, thoracic surgery, trauma surgery	Increased hygiene requirements Recovery rooms, ICU	General hygiene requirements Other rooms used for medical treatment, e.g. ENT
		
Dynamically shielded protection area	Room balancing functions	Air transfer flow / Mixed air

According to DIN 1946-4
Code: – negative pressure, + positive pressure → supply air

HEPA and ULPA filters for operating theatre ceilings: high-efficiency particulate filters for the separation of contaminants, pathogens and tiniest particles
- ➲ 42 to 753 l/s
  150 to 2710 m³/h
- ⧏⧐ W/H/D 305/305/69 to 1830/915/90 mm
  Filter classes H14, U15, U16

Ceiling mounted particulate filters
are used as final filters in areas with the highest requirements of air cleanliness and hygiene such as in the medical, biological, and pharmaceutical industries and other sensitive areas.

TFC ceiling mounted particulate filters as final filters with Mini Pleat filter panels
- For air cleanliness classes 5 to 8 according to ISO 14644-1
- Meet the hygiene requirements of VDI 6022

TFM particulate filter modules
as final filters with Mini Pleat filter panels
- For air cleanliness classes 5 to 8 according to ISO 14644-1
- Meet the hygiene requirements of VDI 6022

KSFS ducted particulate filters
for Mini Pleat filter panels, Mini Pleat filter cells, and activated carbon filter cells
- Contamination-free filter change

► Operating theatre and other sensitive areas: Air filtration ►►

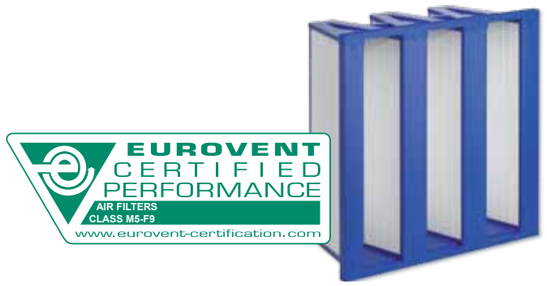
Air provides us with vital oxygen. If our immune system has been compromised, however, the air that we breathe can be life-threatening since pollutants, bacteria, or even a virus may be introduced with each breath taken. A healthy body can withstand such hazards; a body weakened by disease, cannot. This is why the filtration and control of airflows is elementary in hospitals.

In addition to the filtration of fresh air, which is also common to other buildings, hospitals use particulate filters for aseptic areas because they ensure a particularly high air cleanliness and can filter out even the tiniest particles and pathogens. Such filters are ceiling mounted and have a diffuser face.

TROX high efficiency filters.
TROX offers an extensive filter programme for technically and economically sound solutions: Filter units are available for different installation locations, e.g. walls, ducts or ceilings, and suitable filter elements meet every application requirement.

The efficiency of all filters is tested to EN 779 or EN 1822. As standard, TROX fine dust filters of filter classes M5 to F9 (to EN 779) are certified by EUROVENT.

TROX manufactures all parts of filter units in-house, from the casing and filter elements to the diffusers; the TROX filter production facilities in Germany are equipped with the most advanced machinery. Expert sales staff offer comprehensive support to customers. In addition, customers can make use of the intelligent Easy Product Finder design programme.



Particulate filters: Tested to EN 1822:
Filter classification: U16 means that only one particle permeates the filter.

When a U16 filter with an efficiency of 99.99995 % is exposed to 2 million particles, only one particle will not be filtered out. By comparison, an H13 filter (99.95 % efficiency) will be permeated by 1000 particles, and an M6 filter (50 % efficiency) by one million particles.

Particulate filters are subject to efficiency tests before shipping. The overall efficiency is calculated from the measured local filtration efficiencies. When a filter is leak-free and fulfils the criteria of the overall efficiency, it is assigned an individual filter number.

PROCONDIF Profile Controlled Diffusion
These diffusers are also an excellent solution for providing supply air from above to sensitive areas in hospitals, creating a displacement flow in the occupied zone.

➲ 280 to 600 m³/h
78 to 167 l/s
⏮⏭ 600 x 600, 625 x 625 mm

➲ 450 to 1000 m³/h
125 to 278 l/s
⏮⏭ Ø 725 mm

For more solutions and products please visit ***www.trox-hospital-air.com***

VAV terminal unit TVR with EASYLAB control components for room pressure control in critical areas

➲ 10 – 1680 l/s
36 – 6048 m³/h
Δp 20 – 1500 Pa

⏮⏭ Ø 100 – 400 mm

Closed blade air leakage to EN 1751, class 4

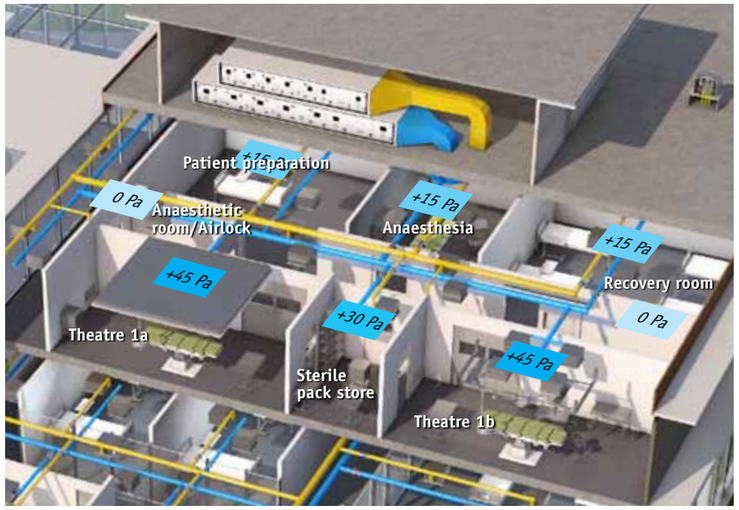
Casing air leakage to EN 1751, class C

► Operating theatre and other sensitive areas: Differential pressure control ►►

Filtration alone is not enough since air can overcome barriers and can, hence, not be locked out easily. With LABCONTROL it is possible to precisely control pressures in the operating theatre and adjoining areas and to isolate rooms with particularly critical requirements of air cleanliness from those with less critical requirements.

LABCONTROL is a control system that provides a tailored solution for safe and energy-efficient airflow control in sensitive areas such as laboratories, clean rooms and hospitals. Quick-response control loops are suitable for the volume flow control in fume cupboards and for room pressure control, e.g. in operating theatres and ICUs. Complex room balancing functions and room monitoring functions are likewise possible.

LABCONTROL has been optimised for complex system requirements such as in hospitals. The system comprises VAV terminal units, electronic controllers, monitoring devices, sensors and control panels. The integral control logic allows for displaying and controlling different room situations precisely. For example, it is possible to switch between operating modes for septic and aseptic rooms, thereby allowing for a flexible room usage. Another advantage of the TROX air control system is the independent room management function. Critical room functions are subject to decentralised control, i.e. they are controlled locally and independent of each other. For example, room pressures can be controlled by external units without any delays. Users can choose to have optical and acoustic alarms also displayed as text messages on the control panel. Even UPS can be integrated. The system allows for flexible bus connections (e.g. BACnet, Modbus or LON) to the BMS.



Critical areas can be isolated by means of precise pressure control and volume flow control.

For more solutions and products please visit ***www.trox-hospital-air.com***

Good air, speedy recovery

A climate of well-being for patients and visitors.

To aid in the recovery and comfort of patients, a sufficient air change rate is a must – ideally with a mechanical ventilation system; opening windows is usually not sufficient. Maximum patient and visitor satisfaction is achieved with a ventilation and air conditioning system that is quiet and creates no draughts.

In-patient wards

A sufficient supply of hygienically safe air is the prerequisite for a rapid recovery. It is not surprising, then, that a perfectly functioning ventilation and air conditioning system is nowadays appreciated by hospitals as a welcome marketing instrument since it ensures patient satisfaction. Innovative air terminal devices with adjustable air distribution elements respond fast and reduce the supply air velocity; lower velocity means less turbulence and hence more comfort for patients.

In many countries, e.g. Spain, France, the UK or the US, air-water systems such as active chilled beams are also allowed. Needless to say that they meet high hygiene requirements, provide efficient filtration and allow for easy cleaning.

Active chilled beams of Type DID-E have been specially developed such that patients are not disturbed while sleeping. The mixed flow air distribution ensures a pleasantly quiet climate of well-being also at night. The DID-E is an active chilled beam with one-way air discharge; it is perfect for patient rooms as it can be installed in such a way that it is not visible, e.g. in ceiling bulkheads.*

The Type DID-E active chilled beams are available in six sizes for volume flow rates from 36 to 281 m³/h and with a heating/cooling capacity of up to 1.7 kW, i.e. for the efficient air conditioning of both smaller single rooms and larger rooms for several patients.

X-GRILLE ventilation grilles combine function with an attractive design. The symmetric blades are supported in the centre and can be adjusted together or individually. They are aerodynamically and acoustically optimised for supply air or extract air. The grilles can easily be removed for cleaning.

The automatic extract air valve ATVC-100 is an electrically operated device that ensures rapid air change and removal of humidity in wet areas. The valve is usually closed or just slightly open but opens fully to remove higher volume flows when the switching contact is made, i.e. when the light is switched on.

* Depending on locally applicable standards and guidelines.

DID-E active chilled beams
Primary air:
➲ 10 – 48 l/s, 36 – 281 m³/h
L 900, 1200, 1500 mm
⇤⇥ W 550, 614 mm
H 200 mm, 598 mm, 623 mm
Cooling capacity up to 1480 W
Heating capacity up to 1730 W

X-GRILLE ventilation grilles
➲ 40 – 3200 l/s
140 – 11,400 m³/h
⇤⇥ B 225 – 1225 mm
H 125 – 525 mm

ATVC-100 automatic extract air valve
➲ 20 l/s
180 m³/h
⇤⇥ Ø 100 mm

For more solutions and products please visit ***www.trox-hospital-air.com***

Hamburg-Eppendorf University Hospital, Hamburg, Germany

TJN jet nozzles
➲ 20 – 1000 l/s
72 – 3600 m³/h
⇤⇥ Ø 160, 200, 250, 315, 400 mm
Plastic

Combination of fire damper and diffuser for F30 fire-resistant suspended ceilings (KU-K30)
Fire resistance class K30-U to DIN 4102-6

*For more solutions and products please visit **www.trox-hospital-air.com***

▸ Public areas ▸▸

Legally binding regulations for hospitals require that in areas other than aseptic areas a ventilation and air conditioning system must be installed when the following conditions apply:

- Opening windows will either not ensure a sufficient air change, or it is not recommended because of the contamination of fresh air or noise break-in.
- The room air must meet certain requirements with regard to temperature, humidity, and cleanliness.
- Hazardous substances (waste gases, micro-organisms) must be removed from the room air.

Lobby/reception: Jet nozzles in the lobby ensure sufficient fresh air and a comfortable, welcoming climate. Modern building management systems (BMS) allow for adapting quickly to changing climate conditions. Room air quality sensors measure the condition of the room air and consequently allow for a demand-based control of the ventilation and air conditioning system.

The versatile, energy-efficient TJN jet nozzles create a comfortable climate in large internal spaces even under the most diverse temperature conditions; and they are an attractive design element.

Corridors and circulation spaces are often at the interior of buildings, and while they are passed quickly on the one hand, they are highly frequented on the other.

KU-K30 fire dampers can be combined with swirl diffusers or ceiling diffusers and serve not only the purpose of fire protection but also that of ventilation. They are suitable for supply air and for extract air systems.

▸ Kitchen and cafeteria ▸▸

Where things are heating up in the kitchen, powerful supply air and extract air systems are required to keep any kitchen odours away from the guests. Especially near the cooker, where hot grease and oil are being used, hygiene and safety are musts.

The KA-EU fire damper for the extract air of commercial kitchens is a compact unit; thanks to its 100 % free area there is no 'additional' pressure drop that might otherwise be caused by the blade. In the event of a fire the damper shuts automatically to prevent the propagation of fire and smoke through ductwork to adjacent designated fire compartments.

When the cafeteria is fully occupied, the staff as well as the ventilation system face a major challenge and must work quietly, efficiently, and without causing turbulence. Both the staff and the system use the time between meals to recover. Room air sensors ensure that the system is switched off when the space is not fully occupied.

The horizontal swirling air discharge of the Type VDW air terminal devices results in high induction of the room air, leading to a rapid reduction in air velocity and airflow temperature.

KA-EU fire damper
⇤⇥ W 250 – 1200 mm
H 225 – 500 mm
Fire resistance class: K90 to DIN 4102

VDW ceiling diffuser
➲ 17 – 360 l/s
60 – 1300 m³/h
⇤⇥ Ø 300 – 625 mm
298 – 825 mm

Hamburg-Eppendorf University Hospital, Hamburg, Germany

A breath of fresh air

For better performance in the workplace.

To neglect mechanical ventilation and air conditioning for the staff areas would be saving at the wrong end. Studies have shown that sufficient fresh air increases the staff's motivation and performance.

Work areas

Common rooms, meeting rooms or offices are not required to have a mechanical ventilation system yet scientists have long known the inspiring effect of good indoor air. They have been able to prove that performance levels may increase by up to 5 %. It is important, though, that the ventilation system is neither heard, nor felt.

Investing into the refurbishment of existing ventilation and air conditioning systems pays off because the economic effect of a favourable indoor air climate is an undisputed fact. If a bad room climate results in just one percent less value added, this actually costs a hospital more than the total capital and operating costs for heating and air conditioning in a whole year.

The DID632 active chilled beam features an optimised nozzle configuration and new geometry. It can provide high cooling capacities at low fresh air flow rates (up to 2500 W at 250 m³/h). This results in low and comfortable air velocities in the occupied zone.

TDV-SilentAIR swirl diffusers feature high volume flow rates at low sound power levels. Supply air discharge in a swirl or horizontally as well as high induction levels ensure a balanced temperature and rapid decrease of the initial airflow velocity. Both square and circular models are available.

TROX silencers provide additional attenuation. Noise causes many health problems and is something one cannot get used to. Acoustic stimuli affect the brain much more and require a much stronger physiological response than other stimuli. This is why noise in ventilation and air conditioning systems must be reduced to levels that are harmless. One way of doing this is installing silencers in ducts.

* Depending on locally applicable standards and guidelines.

DID632 Active chilled beams
Primary air:
➲ 6 – 85 l/s
22 – 306 m³/h
⇹ L 900 – 3000 mm
W 593, 598, 618, 623 mm
H 210 mm
Cooling capacity up to 2500 W
Heating capacity up to 3000 W

TDV-SilentAIR swirl diffusers
Circular; square
➲ 30 – 280 l/s
100 – 1000 m³/h
⇹ Ø 300 – 625 mm
☐ 298 – 623 mm

CA silencers
for the reduction of noise in the circular ducts of air conditioning systems
Circular
⇹ Ø 100 – 1000 mm
L 500 – 1500 mm
Insulation thickness:
50 or 100 mm
Casing air leakage to EN 1751, class A

For more solutions and products please visit www.trox-hospital-air.com

High-tech room air conditioning

Innovative systems work reliably.

A suitable BMS allows for efficient, safe and smooth interaction of all building services. The seamless integration of ventilation and air conditioning with the BMS is ensured by control and monitoring systems that provide comprehensive communication and configuration functions and hence a high level of flexibility.

Centralised air conditioning and air handling

The TROX X-CUBE is an air handling unit with unlimited configuration options of which even the basic version has set a new standard for hygiene and quality. It is only a small step from the top-of-class construction for various applications to an air handling unit specially for hospitals which meets the high hygiene and safety requirements of DIN 1946-4:

- Integration of dampers with the required leakage class 4 to EN 1751
- Powder-coated attenuator splitters
- Stainless steel floor

All other requirements of DIN 1946-4 are already met by the standard X-CUBE air handling unit.

TROX X-CUBE units are very versatile. They can be individually configured and are hence suitable for a wide spectrum of applications. More than 70 construction variants can handle volume flow rates of 1200 to 86,000 m³/h at an airflow velocity of 2 m/s. X-CUBE units are available as supply or extract air units or as a combination of both, arranged side by side or on top of each other, depending on the installation location. The best possible configuration for each application situation can hence be provided.

Thanks to lifting eyes at the top of the cubes they can be easily moved and lifted with a crane. This simplifies installation and reduces the installation time considerably. The intelligent interconnection of all TROX components, devices and the air handling unit ensures reliable overall communication and central control of the system components, which complement each other perfectly.

X-CUBE air handling unit

- Special materials, smooth surfaces on the inside and outside due to high-quality duplex powder coating (corrosion protection class C4)
- With unlimited configuration options, allowing for project-specific adjustments
- Fast and simple installation due to modular construction
- Complete condensate drainage due to stainless steel condensate drip tray, sloped in all directions
- Components are easily accessible for maintenance and cleaning
- Construction variant with measurement and control system is easily connected to the BMS
- High-quality TROX filters
- Heat recovery systems and EC fans ensure high energy efficiency
- Also available as a weather-resistant variant with drip edge and intake hood with tested rain water elimination

X-CUBE air handling units comply with AHU Guideline 01 and are certified by Eurovent. They meet the requirements of all relevant standards and guidelines:

- VDI 6022
- ÖNORM H 6020 and 6021
- SWKI Standard VA 104-01
- DIN 1946-4
- EN 1751
- EN 13053
- EN 1886
- EN 13779

For more solutions and products please visit ***www.trox-hospital-air.com***

X-CUBE

Stainless steel condensate drip tray, sloped in all directions, conforming to relevant standards

Inspection windows and convenient inspection access doors

Made by TROX: from filters to multileaf dampers and sound attenuators

For more solutions and products please visit ***www.trox-hospital-air.com***

▶ Air handling unit ▶▶

We expect a lot – particularly from ourselves. Our X-CUBE air handling unit is the epitome of German engineering at its best. It is the sophisticated details that make the difference, details on which our developers put their focus and which are the result of our engineers' knowledge, skills and experience. It was their goal to create a unit that provides room air of the best quality, air which meets the hygiene and safety requirements in highly sensitive areas such as those in hospitals.

High-efficiency run around coil system.
In this heat recovery system the optional heat exchangers for supply and extract air are connected hydraulically but are otherwise completely separate. A high-efficiency run around coil system prevents the transfer of odours and contaminants; the thermal efficiency is > 70 %.

Ultimate hygiene.
A smooth exterior, smooth, powder-coated surfaces on the inside, stainless steel floors, and stainless steel condensate drip trays, which are sloped in all directions and conform to the relevant standards, meet the most stringent hygiene requirements and withstand commercially available disinfectants. The integral cable duct – which is included in the construction variant with measurement and control system – also meets the highest hygiene requirements.

Easy maintenance and service.
Almost unlimited configuration options with regard to the arrangement of the individual components, and inspection access doors with inspection windows facilitate maintenance of the TROX air handling units to a very high degree. The internal illumination provided by energy-efficient LEDs is yet another example for the high standards we set for our products when it comes to the conservation of resources and to sustainability.

TROX quality through and through.
If we produce it ourselves, we can ensure the best quality. This is our philosophy. And this is why we manufacture as many products as possible in our own facilities. From multileaf dampers with leakage class L2 or L4 (to EN 1751), to sound attenuators with glass fibre fabric and with powder-coated surfaces, and to filter elements that comply with the relevant standards: it's all made in Germany by TROX.

Perfect room air quality in The Royal Children's Hospital, Melbourne, Australia

TROXNETCOM for integration with the BMS
Smoke detector that detects danger early on

Fire dampers with CE marking and declaration of performance according to the CPR

Smoke detectors RM-O-VS-D-LON and RM-O-3-D

With comprehensive self-monitoring functions (contamination, airflow, electronics)

The automatic adjustment of the alarm threshold based on the degree of contamination prevents false alarms and ensures long-term safety.

*For more solutions and products please visit **www.trox-hospital-air.com***

▶ Fire protection ▶▶

Effective fire protection and smoke extract systems save lives.
Ventilation and air conditioning systems are an immensely important factor in the fire protection strategy of a hospital. The prime objective in the event of a fire is to avert danger, i.e. to save lives and to protect equipment. This applies in particular to hospitals, where patients are vulnerable because of poor health or restricted mobility. As a consequence, life-saving equipment must be protected, and escape routes must remain clear.

For TROX, the functional reliability of fire protection and smoke control systems has the highest priority: they are subjected to full risk analyses to ensure that they meet the prime objectives. TROX fire protection components and systems complement each other perfectly such that they fulfil their function reliably in the event of a fire. TROX offers network solutions that link fire dampers and smoke extract dampers, which are SIL2-certified and provide overall safety.

The ventilation and air conditioning ductwork penetrates fire-rated walls and ceiling slabs. In the event of a fire **TROX fire dampers** shut to prevent the propagation of fire and smoke through ductwork to adjacent designated fire compartments. They meet the high requirements of EN 15650 and are CE certified.

Hospitals are buildings with intelligent control sytems. System intelligence requires communication. Here, **TROXNETCOM communication systems** allow for TROX fire dampers to be integrated easily and safely with a BMS or with the X-CUBE air handling unit.

TROX smoke detectors increase safety levels since they detect smoke independent of the temperature, at a very early stage, and trigger the closure of the dampers. The spread of fire and smoke through the ductwork to other hospital areas can hence be avoided in a timely manner.

In hospitals, even more than in other buildings, comprehensive system solutions by TROX ensure functional reliability. Fire and smoke are detected at an early stage such that their spread can be prevented and people can leave the building on smoke free escape routes.

The Royal Women's Hospital, Melbourne, Australia

X-FANS smoke exhaust fans
are available for 200 °C, 300 °C, 400 °C and 600 °C

There are four types of X-FANS smoke exhaust fans:
- Roof fans
- Axial fans
- Centrifugal fans
- Wall fans

The smoke exhaust fans have two operating modes:
- Permanent ventilation and smoke exhaust in the event of a fire
- Smoke exhaust only

X Fans

For more solutions and products please visit ***www.trox-hospital-air.com***

▶ Mechanical smoke exhaust ▶▶

In complex buildings, such as hospitals, a smouldering fire that is detected too late can easily have disastrous consequences. Mechanical smoke exhaust systems can provide a higher level of safety than other systems. They create smoke-free layers along the escape and rescue routes and therefore allow hospital staff to take patients and vital equipment out of the danger zone. Smoke exhaust fans remove smoke gases, thus preventing smoke from spreading uncontrollably and supporting the firefighters in extinguishing the fire.

Mechanical pressurised smoke exhaust systems remove not only smoke but also dissipate the heat, thus preventing a dangerous flash over. The required air transfer dampers open at the same time.

Requirements of a pressurisation system for smoke extract by the creation of layers:
Keeping the layer with smoke gases separate from the smoke-free layer requires a delicate combination of supply and extract air; the following conditions must be met in particular:

- At the boundary between the smoke gas layer and the smoke-free layer, only minimal horizontal and vertical airflows at low velocities should be present, if at all.
- Supply air openings must be adequately sized and be installed at the right distance from each other. They must open automatically before the smoke exhaust fans are switched on.
- Supply air must be discharged into the smoke compartment considerably below the layer with smoke gas, ideally with no or very little impulse, and at a low velocity (< 3 m/s).
- The smoke exhaust openings should be at regular distances and ideally at the highest point.
- The smoke compartment must be limited with regard to the required smoke-free layer, the thermal capacity of the surrounding structure, and the fire capacity to be considered.
- The condition of the fans is to be inspected regularly. The integral X-FANS diagnosis system helps to detect any damages at an early stage and thus allows for condition-based maintenance.
- Keeping spaces free from smoke – pressurisation systems: Systems must be in place that keep escape and rescue routes, especially stairwells, free from smoke. The supply air must be discharged into the direction of the fire and away from the areas to be protected.

Centre Hospitalier Universitaire Pontchaillou, Rennes, France

▶ Healthy air thanks to TROX ▶▶

TROX has provided numerous hospitals, sanatoriums and care facilities all over the world with ventilation and air conditioning systems and hence with healthy air:

AACHEN University Hospital • ATHENS Oncological Children's Hospital • BERLIN Charité • CARTAGENA Hospital • BELO HORIZONTE Unimed Hospital de Santa Bárbara • DURBAN Albert Luthuli Hospital • DÜSSELDORF Sana Hospitals • ENSCHEDE Medisch Spectrum Twente (MZT) • ESSEN Essen-Süd Hospitals • GREENSBORO Moses H. Cone Memorial Hospital • HAMBURG Eppendorf University Hospital • KRAPINSKE TOPLICE Hospital Magdalena • LODZ Kopernik Hospital • MELBOURNE The Royal Children's Hospital • MELBOURNE The Royal Women's Hospital • MOSCOW Clinical Centre of Paediatrics • RENNES Centre Hospitalier Universitaire Pontchaillou • WESEL Evangelical Hospital ...

TROX® TECHNIK

The art of handling air

TROX GmbH
Heinrich-Trox-Platz
47504 Neukirchen-Vluyn, Germany
Phone +49 (0) 2845 2020
Fax +49 (0) 2845 202265
www.troxtechnik.com
trox@trox.de