TROX® TECHNIK
The art of handling air

CLEAN 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 global leader of innovation in these fields.

Application-oriented clean room solutions.
In highly sensitive areas ventilation and air conditioning have to meet specific and extremely stringent requirements. TROX clean room technology meets the highest protection and safety standards, and it is found in many highly sensitive areas such as:

- Research facilities, laboratories with fume cupboards, livestock facilities
- Ultra clean production environments in the area of life sciences, optics and laser technology, nano technology, and semiconductor production
- Operating theatres and sterile areas in hospitals and health care facilities (see TROX application brochure for hospitals)
- Rooms that require a special volume flow rate and pressure control, e.g. control rooms and meeting rooms

COMPREHENSIVE SYSTEM SOLUTIONS

This application brochure deals primarily with the air distribution and air handling in clean rooms. The reliability and safety of a ventilation and air conditioning system depend on effective airflow management, i.e. on the coordinated interaction of all components.

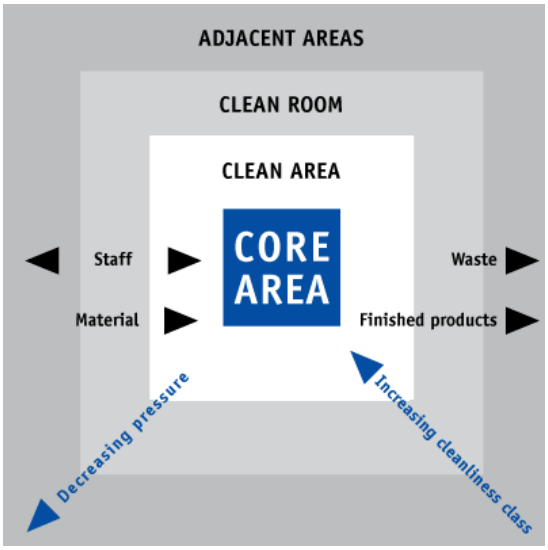
One-stop shop. Complete solutions from a single source.
TROX offers bespoke, complete ventilation and air conditioning solutions from a single source: Air handling units and fans, measurement and control components, and a unique range of aerodynamically optimised air terminal devices, filters, and fire protection and smoke control components all deal with the various stages of the airflow.

Where work safety and the protection of valuable products, people and the environment are priorities, it is of paramount importance that all components of a clean air system complement each other perfectly.

Fewer interfaces, less coordination effort.
The advantages for specialist consultants and HVAC contractors are obvious: one face to the customer – for efficient ventilation and air conditioning systems. The result is a drastic reduction of the usual interface or coordination problems. All ventilation and air conditioning components from TROX are engineered in Germany.

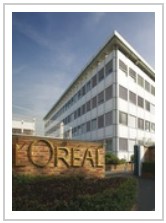
TROX has both the know-how and the necessary expertise to set the highest standards in the field of air distribution for clean rooms. Since 1998 our clean room experts have been members of the standards committees for the EN 1822, EN 14175, DIN 1946 Part 7, and other guidelines and have provided valuable input to these bodies.

SAFETY FOR PRODUCTS AND PROCESSES



Ventilation and air conditioning in clean rooms means, first and foremost, controlling undesired airborne particles. This is why we at TROX have thoroughly examined the measures that reduce or minimise adverse effects on people, products and the environment in order to develop complete solutions. Controlling the diverse, interdependent factors which influence air cleanliness and safety has led to the development of extremely reliable and energy-efficient clean room systems that address the following aspects:

- Air treatment, transport, filtration, and discharge: Ensuring a high level of air cleanliness and a good room air quality
- Air management: Protecting products, processes, people (highest quality standards for production) and the environment from contaminated air by maintaining the required volume flow rates and balances
- Fire protection: Preventing the spread of contaminated air and of fire and smoke through ducting in the event of a fire



ENERGY EFFICIENCY

Demand-based optimisation saves energy.
In most companies today, work does not end at 5 p.m. sharp. This is why many systems are running 24 hours a day, 365 days a year, even though they are really needed only about 50 % of the time. It should, hence, be possible to operate building services effectively but also flexibly, and not necessarily with full power for 24 hours a day.

Air distribution systems from TROX provide intelligent, demand-based volume flow rate control and consequently ensure a high level of energy efficiency. The systems run with full power only when people are working in the factory or in the lab. When a space is not occupied, the air change rate is reduced.
This offers a considerable savings potential over time.

Energy savings potential in existing systems.
When it comes to energy efficiency, ventilation and air conditioning systems have come a long way. This is why a considerable energy savings potential lies dormant in older systems. The modernisation of ventilation and air conditioning systems by suitable measures, e.g. by fitting air handling units with frequency converters or installing VAV terminal units, may reduce the energy requirement of these systems by as much as 40 %. Such investments pay off, often within only two years.

Increasing efficiency with filters and air handling units.
Filters are supposed to separate particles in the air – and they are an obstacle to the airflow. As the differential pressure increases, the energy efficiency decreases. The goal is minimising the loss. TROX has developed filters that reduce the unavoidable differential pressure increase and hence increase energy efficiency. TROX offers filter media with extremely fine pleats and aerodynamically optimised filter units that help to save up to 50 % energy.

TROX air handling units are very energy efficient because they are equipped with state-of-the-art heat recovery systems and innovative high-efficiency fans.

TROX LÖSUNGEN FÜR DIE REINRAUM-LUFTTECHNIK

CLEAN SOLUTIONS START WITH PLANNING

Comprehensive and flexible solutions for every requirement.
On the following pages we present innovative clean room systems made by TROX. Our goal is to give you ideas for the design and implementation of ventilation and air conditioning systems for clean rooms and to show you options for different ventilation requirements.

The table on the fold-out page lists the relevant standards and guidelines and offers practical design advice with regard to the ventilation and air conditioning of clean rooms. You are then invited to follow the way of the air from the air handling unit to the air terminal devices.

STRATEGIES FOR CLEAN ROOMS

Close cooperation leads to innovative room air strategies

Developing and implementing a comprehensive room air conditioning strategy that meets the most critical safety and comfort requirements is only possible through the close cooperation of specialist consultants, HVAC contractors, users and manufacturers, and then from the beginning, i.e. from the design stage onwards. The know-how and the complete TROX product portfolio is, however, also ideally suited for refurbishment projects.

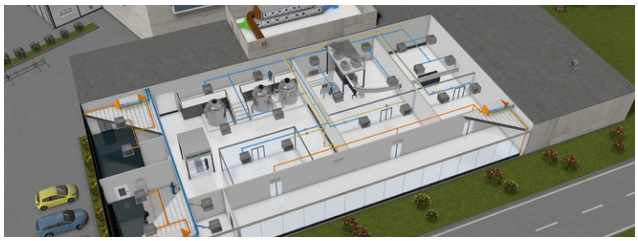
The illustration on the fold-out page shows you how a clean room production facility can be equipped with innovative TROX products and systems.

Air handling
- High-tech room air conditioning
  For the highest levels of hygiene
- and safety
  X-CUBE CROFCU reduces
- energy costs

Air management
  Intelligent communication
- systems
- Stable pressure
- Room balancing

Air filtration

- Protecting products and people
- TROX air filtration systems
  Air distribution strategies for
- clean rooms
- Air terminal devices



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Air cleanliness classes to ...							
Nomenclature		Max. allowable number of particles per m³					
ISO 14644-1 a)	EU GMP Guideline a)	≥ 0.1 µm	≥ 0.2 µm	≥ 0.3 µm	≥ 0.5 µm	≥ 1.0 µm	≥ 5.0 µm
1		10	2				
2		100	24	10	4		
3		1,000	237	102	35	8	
4		10,000	2,370	1,020	352	83	
	A / B				3,500		0
5		100,000	23,700	10,200	3,520	832	29
6		1,000,000	237,000	102,000	35,200	8,320	293
	C				350,000		2,000
7					352,000	83,200	2,930
	D				3,500,000		20,000
8					3,520,000	832,000	29,300
9					35,200,000	8,320,000	293,000

Types of ventilation and filters (ISO 14644)						
ISO classification b)	8	7	6	5	4	3
Typical type of ventilation	Turbulent flow TF or mixed flow M (combination of low-turbulence laminar flow LF and turbulent flow TF)			Low-turbulence laminar flow LF		
Typical prefilters, 1st stage	M5	M5	M5	M5 / F7	M5 / F9	M5 / F9
Typical secondary filters, 2nd stage	F7	F9	F9	E11	H13	H13
Typical final filters	E11 / H13	H13	H13	H14	U15	U16
Max. number of months allowed between tests to prove continued compliance with the allowable particle concentration	12	12	12	6	6	6
Recommended max. number of months between standard tests to carry out optional tests – leakage of installed filters	24	24	24	24	24	24

Examples of clean rooms in microelectronics (ISO 14644-4)						
ISO classification b)	8	7	6	5	4	3
Type of ventilation	TF or M	TF or M	TF or M e)	LF	LF	LF
Average airflow velocity d)	not given	not given	not given	0.2 to 0.5	0.3 to 0.5	0.3 to 0.5
Air changes per hour e)	10 to 20	30 to 70	10 to 160	not given	not given	not given

a) Note operating states (shown: idle operation)
b) For the best results, operating states in connection with ISO classification should be determined before starting the design process.
c) With an effective barrier between the source of contamination and areas that are to be protected. This can be a mechanical system barrier or an aerodynamic barrier.
d) Low-turbulence laminar flow in a clean room usually depends on the mean airflow velocity. The required low-turbulence airflow velocity depends on local characteristics such as geometry and thermal conditions. This is not necessarily the face velocity for the filter.
e) Turbulent flow and mixed flow are determined by the air change rate (air changes per hour). The suggested air change rates apply to 3.0 m high rooms.

X-CUBE air handling units handle volume flow rates of up to 86,000 m³/h (24,000 l/s) for the ventilation and air conditioning of rooms – including filtration, heating, cooling, heat recovery, and humidifying

cooling, heat recovery, and humidifying and dehumidifying.

X-CUBE CROFCU Clean Room Fan Coil Unit
is a compact secondary ventilation unit that offers a multitude of features to meet the ventilation requirements of class C and class D clean rooms.

TROX room air management systems provide demand-based volume flow rate control to ensure the best possible room air quality and temperature while they help to save energy at the same time. They maintain the correct pressure in clean rooms and prevent the transfer of air between different rooms or through air locks.

Filters M5
are used in ventilation and air conditioning systems to separate contaminants from the air.

Fine dust filters F7
are used for the separation of fine dust in ventilation systems that must meet demanding requirements. TROX filters of filter classes M5 to F9 are tested to EN 779 and certified by EUROVENT.

Particulate filters H14
with Mini Pleat filter panels are used as final filters for the separation of suspended particles in industrial, research, medical, and pharmaceutical applications.

Ceiling mounted particulate filters
with Mini Pleat filter panels are used as final filter stage and are acoustically and aerodynamically optimised; they are available in many designs and constructions and provide a solution for all architectural requirements.

Wall mounted particulate filters
come with a sealing integrity test facility, a pressure measurement point, and a clamping mechanism for fixing Mini Pleat filter panels.

Single ventilation grilles and continuous horizontal runs
with adjustable front blades can be installed in walls and in circular and rectangular ducts.

TROXNETCOM
makes use of advanced, decentralised and open communication systems, and hence allows for economical fire protection systems that can be integrated into the central building management system with very little wiring.

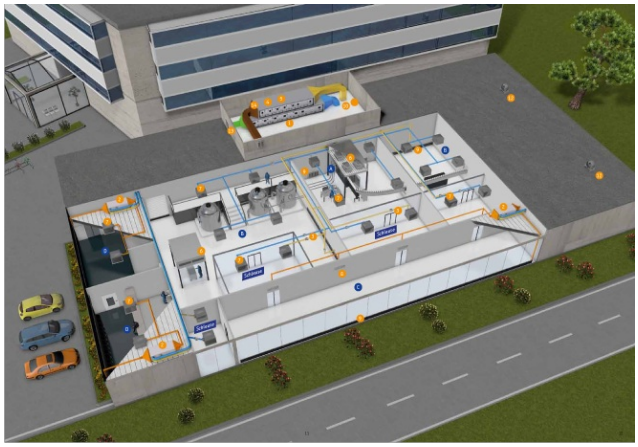
Fire dampers
are certified for all European countries and prevent fire and smoke from spreading through ventilation ducting. The fire area is consequently isolated from other parts of the building.

X-FANS smoke exhaust fans
remove the hazardous fire gases in the

remove the hazardous fire gases in the event of a fire. Escape routes are kept free from smoke such that the building can be evacuated without any problems.
External weather louvres
protect air conditioning systems against the direct ingress of rain, leaves and birds into fresh air and exhaust air openings.
Multileaf dampers
provide a means for shut-off, and they prevent air from flowing against the intended airflow direction.
Combinations of external weather louvres and multileaf dampers or non-return dampers have a dual function.
One-stop shop.

In addition to the products shown here, TROX offers many more and in fact covers the entire range of components and systems for ventilation and air conditioning:

- Mixed flow and displacement flow diffusers; diffusers for ceiling, wall and floor installation
- Air-water systems
- Decentralised ventilation systems
- Splitter attenuators and circular silencers
- X-FANS ventilation fans
- X-FANS smoke exhaust fans
- X-FANS jet fans for underground car park ventilation and smoke exhaust



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- Revisionsunterlagen
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- BIM
- TROX ACADEMY

Ansprechpartner

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