DENIOS

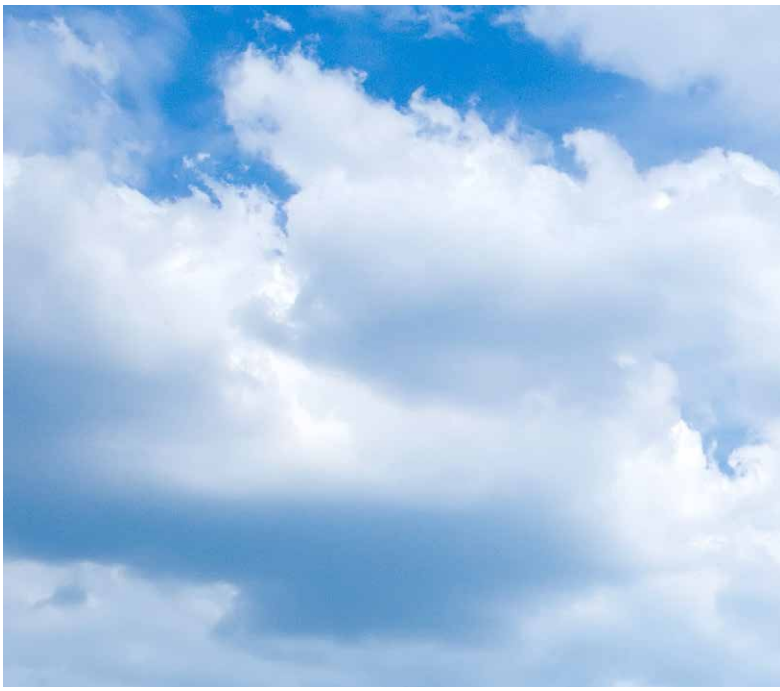
ENVIRONMENTAL PROTECTION
& WORK SAFETY

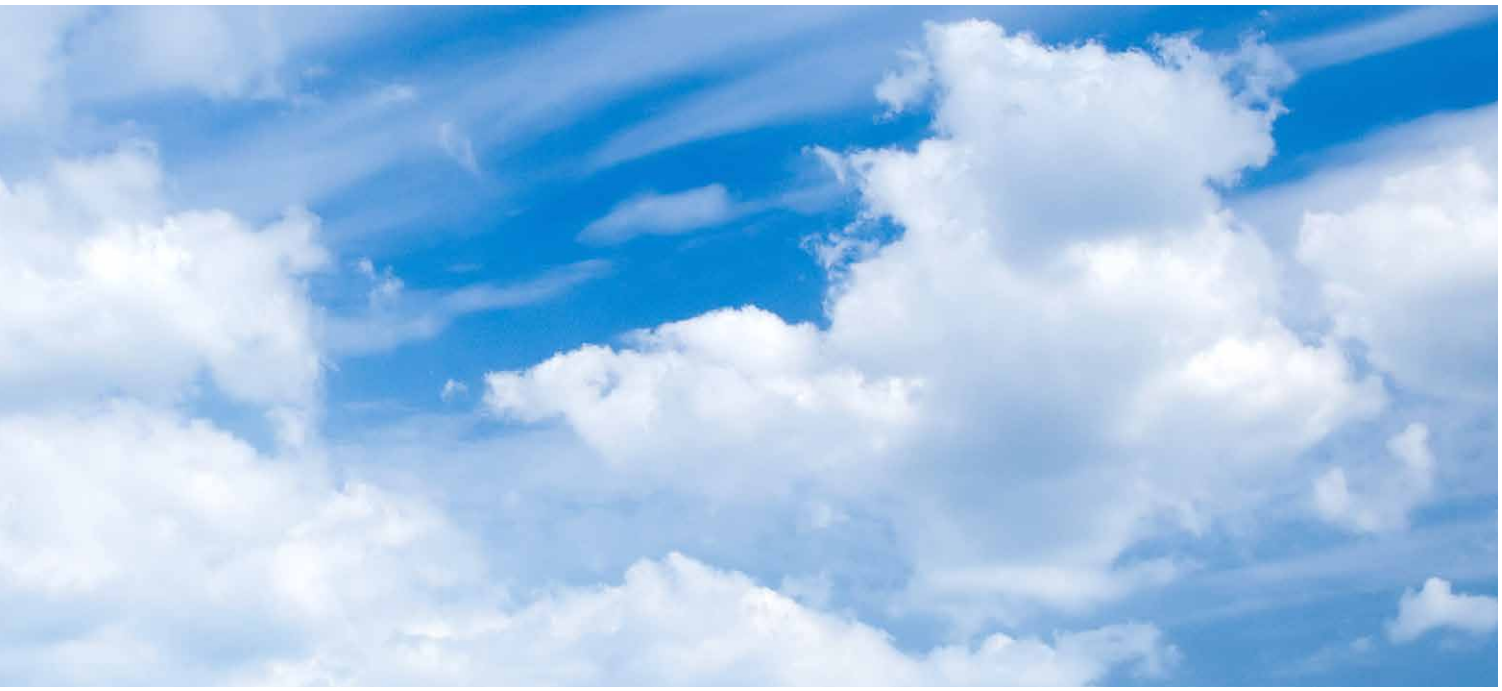
Containment technology

Protection for people, products and rooms

- Safety work benches
- Free workstations
- Clean air and containment solutions

Reliable protection of people, products and the environment





Taking responsibility — every day

Acetone, phosphorous, peroxide, tetrachloromethane, hydrofluoric acid... the list goes on. Often with unimposing names, they are all commonly found in production processes as raw materials, additives, waste products or as the desired end product of production. The problem is, they are flammable, oxidising, toxic or even potentially explosive. Hazardous substances are an important part of many industrial processes. Their potential dangers are often considerable and handling them entails risks for people, the environment and companies alike.

The responsibility for these hazardous substances lies with their producer. They face the challenge of reducing the handling risks involved to a minimum. At DENIOS, our expertise in safe, legally-compliant handling and storage of hazardous substances dates right back to 1986. We know the many obligations a company like yours must satisfy in order to meet its daily responsibilities. Our solutions here at DENIOS provide effective protection for employees, the environment and corporate values so that you can take on your daily challenges both actively and responsibly.

Made to measure hazardous substance capture

In the chemical or pharmaceutical industries, production will normally involve the handling of hazardous chemicals. Regardless of the material, trades may find that emissions are produced which are harmful to health or environmentally damaging.

For each work environment in a trade or industry setting, DENIOS will design a suitable containment technology solution. Our product offering ranges from extraction tables for workshop welding tasks, to laboratory HazMat-workstations or a complete house-in-house system under cleanroom conditions. Economical use and integration into your processes are key factors. DENIOS offers effective protection from harmful emissions for people, products and the environment.

For over 30 years, DENIOS has been designing and building solutions for handling and storing hazardous substances. All our products are manufactured in our own production facilities by specially trained experts. Containment solutions from DENIOS are of course certified and legally-compliant.

Contents

Overview of the DENIOS product range

Overview

Free workstations

Safety work benches

Clean air and containment solutions

Hazardous substance workstations for laboratories

DENIOS containment technology in the trade press

Industrial extraction systems

Project management and Service

Optimum protection and efficiency – expertly combined

DENIOS – Designs for the future

When working with hazardous substances and their associated harmful emissions, protection of both employees and the environment is the top priority.

DENIOS' aim is to provide you with the optimum technical solution to meet your individual requirements, meaning that optimal protection can be effectively combined with economical operation.

Made to measure solutions with the highest levels of quality

Decades of experience and in-depth sector knowledge enable our specialists to develop suitable solutions for your application.

In addition to the ergonomic, economic and energy requirements, our clean air and containment solutions meet the highest standards for personal, room and product protection.

DENIOS offers a wide but extremely specialised range of ventilation designs. Professional advice from your personal project manager will help guide you to the ideal solution. Take advantage of custom-made solutions with an optimum cost/benefit design.

Containment and harmful substance capture in the workplace

From reliable harmful substance capture in an industrial setting to demanding GMP-compliant high containment solutions in the pharmaceutical sector.

Whether it's a work bench, free workstation or cleanroom and sampling area, as a House-in-house solution, DENIOS solutions always meet the special requirements of each individual workplace.

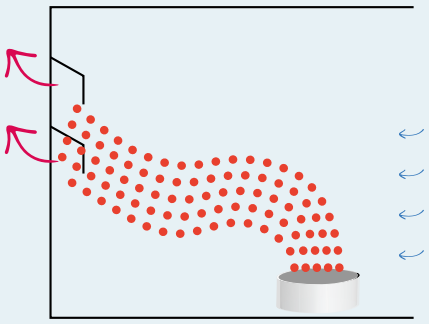
The VARIO Flow system

Various hazardous substances - various production conditions and requirements:
Every day DENIOS employees come up against the most varied demands. Our engineers have access to various ventilation and containment technologies so that these demands for efficient personal, room and/or product protection can be met with a highly flexible response. VARIO Flow is DENIOS' solution allowing exceptional flexibility and adaptability. Depending on the application, DENIOS engineers will use various ventilation technologies to develop a suitable solution, from a simple extraction unit to a high-purity laminar downflow solution.

Horizontal extraction flow

Clean air extraction systems with horizontal displacement flow work according to the "vacuum principle". The air speed in the work area is set high enough so that harmful substances are carried away.
Equipment with horizontal displacement flow are ideal for processes with short operating times and in demanding industrial applications.

- Clean air extraction
- Ideal for use in demanding industrial applications
- High air speeds
- Suitable for short operating times
- Comparatively high extraction volumes



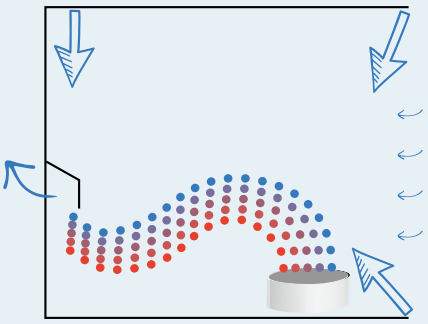
Product examples:

- Compact safety work benches (p. 12 – 15)
- Compact free workstations (p. 46 – 49)
- Extraction arms and mobile extraction units (p. 38 – 42)

Ejector technology

Systems with ejector technology have air extraction and also targeted air inlet flows via optimally arranged ejector nozzles (**push-pull principle**). Airborne harmful substances such as particles or gases are safely captured by these stable air curtains and directed to the extraction system. This ensures the principle of optimum safety for people and the surrounding area.

- Protection for people and rooms
- Use of targeted clean air curtains
- High retention
- Enables barrier-free working without a front screen
- Low air requirement / low air extraction volume
- Efficient and cost-effective



Product examples:

- Premium safety work benches (p. 16 – 19)
- Premium free workstations (p. 50 – 53)
- Laboratory workplaces (p. 32 – 37)

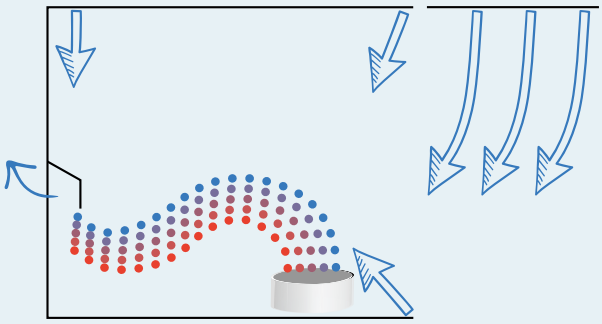
VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

✓ **Personal protection**
✓ **Room protection**
✓ **Product protection**

Combined technology: Ejector technology + Laminar downflow

This technology combines conventional laminar downflow technology (LF) with ejector technology. Ejector technology ensures harmful substances are extracted, the LF technology ensures product protection thanks to a highly filtered air supply at the opening.

- Combination of ejector technology and laminar downflow
- Ensures optimum protection of people and rooms while also ensuring product protection
- Flexible technology for complex requirements
- Low air requirement compared to pure laminar downflow solutions
- Clean air via laminar blower plenum at the front



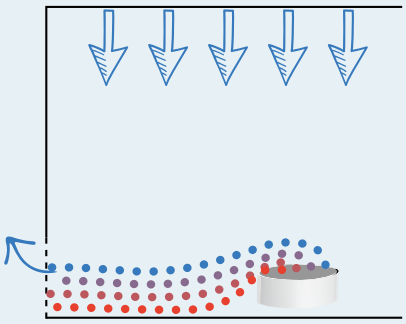
Product examples:

- Pharma safety work benches (p. 22–25)
- Pharma free workstations (p. 54–57)

Vertical displacement flow: Laminar downflow

The individually fabricated laminar downflow systems offer comprehensive safety alongside optimum freedom of movement for the user. A clean, low turbulent airflow moves vertically through the working area and is extracted near the floor. Airborne particles are captured in a controlled manner and directed away. The local environment is permanently protected and cross contamination is avoided.

- High degree of employee protection with effective containment technology and high air exchange rate
- Can be used for high containment and cleaning requirements
- Laminar, low turbulent airflow directs harmful substances downwards
- Handling of hazardous and potent substances with high levels of personal protection and optimum freedom of movement



Product examples:

- Laminar downflow safety work benches and booths (from p. 66)
- Sampling areas and House-in-house solutions (from p. 74)

Safety work benches

- Compact model
- Premium model
- Pharma model
- Individual solutions

The best protection for workers and workspaces, combined with product protection

Personal, room and/or product protection: every production operation and production stage has different protection requirements for people, operations and products.

DENIOS safety work benches and safety workbenches are adapted to your application with various ventilation technologies and individual equipment options:

- **Compact model**
- **Premium model**
- **Pharma model**

The standard requirements for all DENIOS containment technology products are:

- Safe extraction of hazardous emissions
- Reliable protection of people, the environment and products
- Low air volumes for permanent operation
- Low noise levels
- Integration into existing room ventilation designs
- High levels of flexibility/adaptability to client requirements

✓ **Personal protection**
✓ **Room protection**
✓ **Product protection**

VARIO Flow safety work benches

Vario Flow safety work benches offer the perfect solution for carrying out a clearly defined range of sensitive work processes in a protected manner.

Depending on your application, one of the three ranges mentioned above will be suitable – as a standard version or customised to suit your requirements.

VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

AT Premium work bench in high quality stainless steel

Areas of application for the various models:

Compact model

- Filling
- Dispensing
- Painting
- Grinding
- Washing
- Cleaning
- Evaporation
- Pumping
- Soaking

➡ **p. 12–15**
Compact work bench

Premium model

- Dosing
- Weighing
- Filling
- Dispensing
- Cleaning
- Sampling

➡ **p. 16–19**
Premium work bench

Pharma model

- Sample taking
- Withdrawing samples
- Mixing
- Dosing processes
- Weighing tasks
- Dispensing tasks
- GMP/FDA conformity
- Working with product safety

➡ **p. 22–25**
Pharma work bench

Safety work benches

Compact model

Optimum - with integral splashguard

Compact safety work benches offer cost-effective protection for the demanding industrial sector. They are especially suited to short work processes. Important for protecting your employees: Even when moving quickly within the work area the Containment technology will operate reliably and effectively.

Containment technology: Horizontal extraction flow

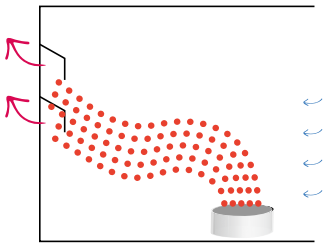
Powerful fans ensure an airflow from the environment towards the extraction vents.

With air speeds up to 0.5 m/s at the entry harmful substances and emissions in the work area are safely captured, effectively retained and extracted.

The compact work benches' folding front safety screen protects your employees from emissions or acts as a splashguard, e.g. during cleaning tasks.

Typical areas of application

- Filling
- Painting
- Grinding
- Washing
- Cleaning
- Evaporation
- Pumping
- Soaking



Protection and safety

DENIOS designs ensure outstanding work safety and user-friendliness. They also offer optimum access to the worksurfaces in every situation.

In practical terms this means:

- Safe working and placement of even bulky objects on the worksurface
- Unimpeded access to all working equipment even with a front safety screen
- Washing and rinsing basins for cleaning tasks can be integrated

Operating principle

Compact work bench functional drawing

The horizontal extraction flow ensures the airflows from the equipment entry towards the extraction vents. This ensures an air speed of up to 0.5 m/s at the free cross-section at the entry.

In this way, improved protection for both people and the room can be ensured, especially for workplaces with short operation times.

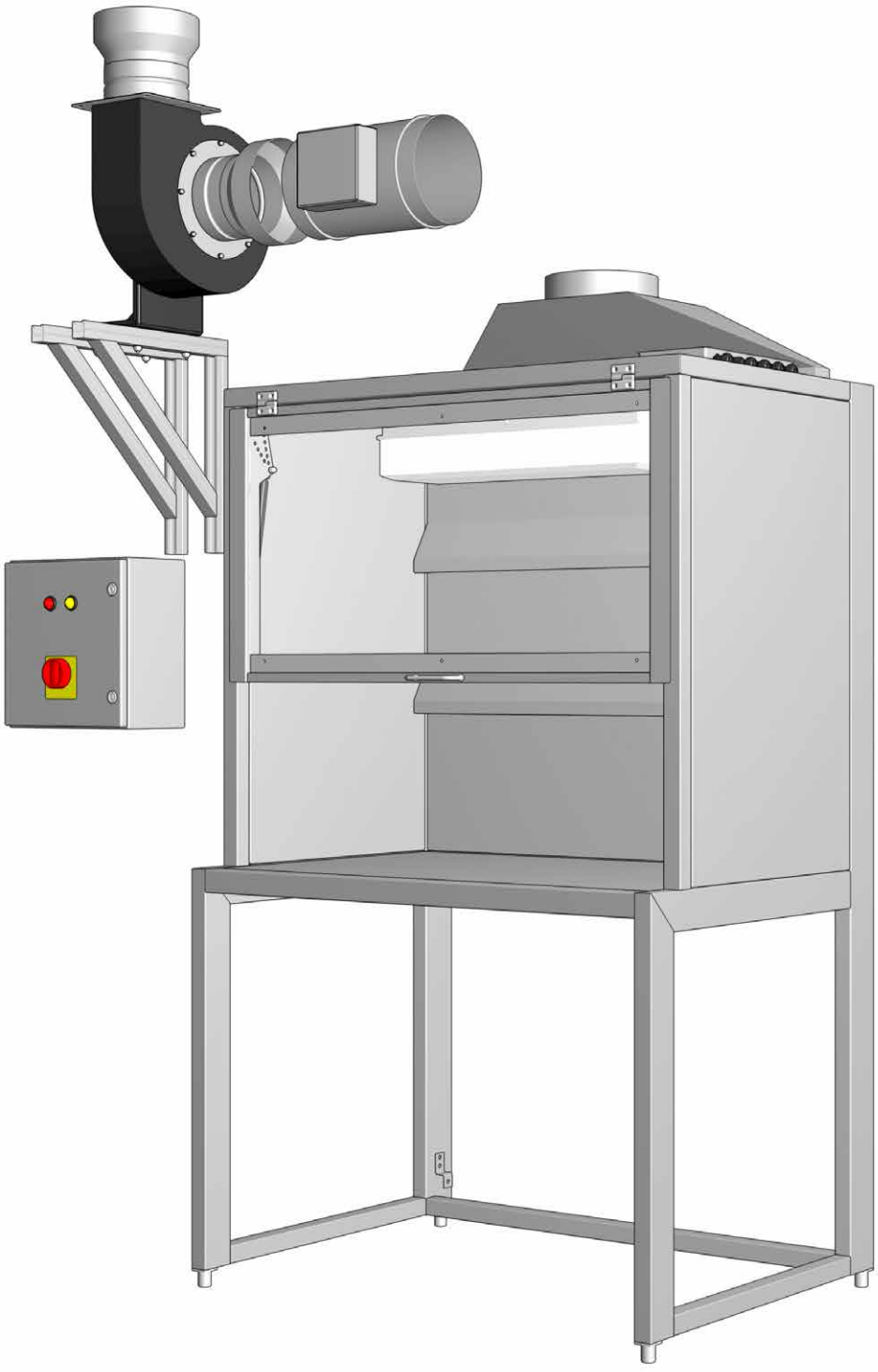
Info

If required, ATEX conformity in accordance with RL 2014/34/EU is available

Systematic safety - equipment

The following examples form part of the basic equipment:

- Sturdy frame construction in steel
- Visible surfaces are powder coated or optionally in V2A stainless steel
- Worksurfaces and basins in stainless steel, corrosion-free, and can resist intensive use with aggressive substances
- Worksurfaces with a load capacity of 150 kg



Additional options

Extraction fans, integrated filter technology, ATEX-proof design etc. – with a wide range of additional equipment, DENIOS will have the optimum solution for your requirements.

Let our engineers show you how an optimised VARIO Flow solution could work.

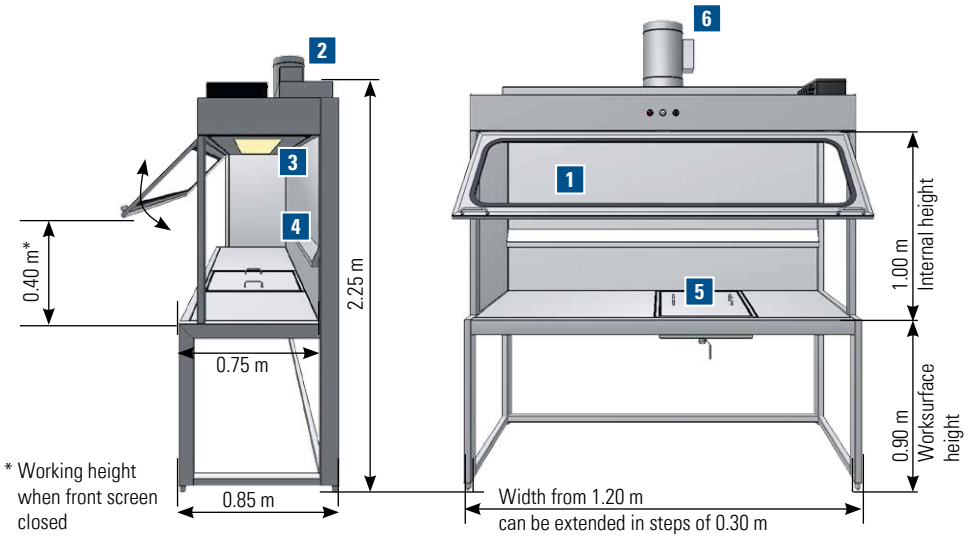
For more information on dimensions, basic equipment and practical examples, please see page ➡ 14

VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

Compact – Dimensions and equipment

System description

Air in the room is sucked in at a speed of up to 0.5 m/s at the free cross-section under the safety screen. Emissions are safely captured by this airflow and directed to the extraction vents. Above the table, there is a connection for the extraction fan or a customer ventilation system.



1 Front safety screen
2 Air extraction connections
3 Lighting
4 Extraction vents
5 Washing basin (optional)
6 Volume flow controller (optional)

Equipment

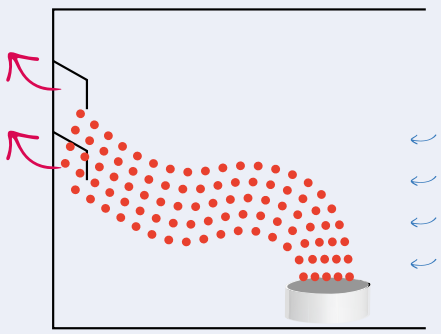
Basic equipment

- Sturdy steel frame construction (powder coated or optionally in stainless steel)
- Width from 1.20 m (can be extended in steps of 0.30 m)
- Closed rear and side walls in steel, powder coated
- Worksurface in stainless steel, corrosion free, even under intensive use
- Strong worksurface, load capacity 150 kg
- Exhaust air connection: Exhaust air connection for connecting customer's ventilation equipment or an extraction fan
- Lighting
- Front safety screen folds up

Additional equipment

- Frame and cladding components available in resistant stainless steel (V2A)
- ATEX-proof design
- Washing/draining basins in the worksurface
- Media connections e.g. sockets
- Side walls in safety glass
- Control system/switch cabinet
- Filter technology in the rear wall or in separate filter unit
- Fire-rated F90 underbench cabinets
- Extractor fans
- Control flap and volume flow controller
- Monitoring unit (filters, extraction etc.)

Containment technology



Dimensions and technical data

Compact model	External dimensions W x D x H (m)	Internal height Overall (mm)	Working height* (mm)	Work area dimensions W x D (m)	Work area (m^2)	Air extraction volume flow (m^3/h)	Pressure loss (Pa)
AT-12	1.20 x 0.85 x 2.25	1000	400	1.10 x 0.75	0.80	870	150
AT-15	1.50 x 0.85 x 2.25	1000	400	1.40 x 0.75	1.05	1080	150
AT-18	1.80 x 0.85 x 2.25	1000	400	1.70 x 0.75	1.28	1300	150
AT-21	2.10 x 0.85 x 2.25	1000	400	2.00 x 0.75	1.50	1520	150

Practical examples

Work bench AT-27 Compact

Consisting of a cleaning area and an evaporation area

- Manual lift and lower for removing the strainer basket from the basin
- Washing brush with supply pump
- Air extraction monitoring
- Dissipative strip curtain separates work areas
- Frame and surfaces in resistant stainless steel V2A

AT-21 Compact work bench – Overall width 2100 mm

Application: Soaking and cleaning of contaminated components using solvents.

- Work area consists of a continuous washing basin with drain tap
- Lid for covering the washing basin

AT-15 Compact work bench for cleaning and painting tasks

- Worksurface with 3 basins for dyes and paints
- Flexible drain pipe for waste
- Powerful extraction fan and air extraction monitoring
- Various media connections e.g. power and compressed air

Additional practical examples can be found at denios.shop/projekt

Safety work benches

Premium model

Protection and safety

The containment technology used here combines maximum safety for your employees with tangible economic advantages. The main advantage of this technology is the ability to work safely without a front screen. Unrestricted access to the work area optimises working comfort while ensuring the highest levels of safety for your workers. The low operating costs ensured by the high-efficiency ejectors also add an additional reason to consider this impressive DENIOS design.

Containment technology: Ejector technology

The ejector nozzles used are designed to work together, ensuring a stable air curtain to effectively protect the work area from the environment.

Special nozzles at the front edge of the worksurface and at the roof direct the air jets, or ejectors, towards the extraction vents in the rear wall.

The airflow created blows all vapours and dusts towards the rear wall, where they are safely extracted. In this way harmful emissions are safely removed with the minimum air requirement.

Advantage
With air speeds of 0.15 m/s at the entry, there is no draught for the worker. No substances are "forcibly" carried away.

Proven protection - low costs

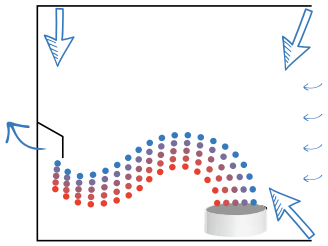
The ejector technology is designed for work processes which require a draught-free environment.
They offer the highest level of protection from emissions for workers and the environment - an indispensable requirement for working with toxic substances.

Save money with DENIOS ejector technology!
The minimal air requirement means a lower level of power usage for the fans - an essential benefit when considering permanent operation.

Work benches with ejector technology offer excellent performance and only need a very small amount of air compared to conventional extraction equipment. This means very low energy requirements, helping to protect the environment.

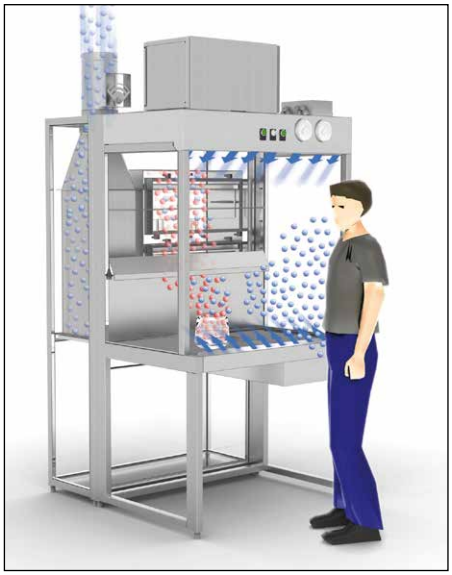
Typical areas of application

- Dosing
- Weighing
- Filling
- Dispensing
- Cleaning
- Sampling



VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

Operating principle



Premium work bench functional drawing

The targeted air curtain created by the ejectors separates product, emission source and worker, protecting the worker and surrounding space. Emissions released, e.g. dusts or gases are captured by the clean air curtains and directed towards the extraction system in the rear wall. The clean air curtains are created by the ejector nozzles at the hood, rear wall and front edge of the table. They are designed to work perfectly together in terms of performance, shape and direction as well as speed and volume. The efficient air curtains are completely stable even when the worker moves around a significant amount during his tasks.

Despite the especially high capture and extraction performance, the Premium work bench only uses a low volume of air compared to conventional extraction systems. This considerably reduces operating costs.

Info

If required, ATEX conformity in accordance with RL 2014/34/EU is available

Type test

Design in accordance with
EN 14175-3

The Premium VARIO Flow work bench can be supplied for use with substances with OEL/OEB threshold values 3 and 4 if required.

The targeted removal of emissions via the extraction points means that the inner height can be fully used without limitations. The air curtains remain stable even when movement-intensive operations are being carried out and when the worker puts his hand through the curtain - no hazardous substances will enter the surrounding environment.

Safety with System - equipment

The Premium model offers the highest levels of safety and has a general design permitting customisable solutions. For this reason we offer a wide range of additional equipment, for example

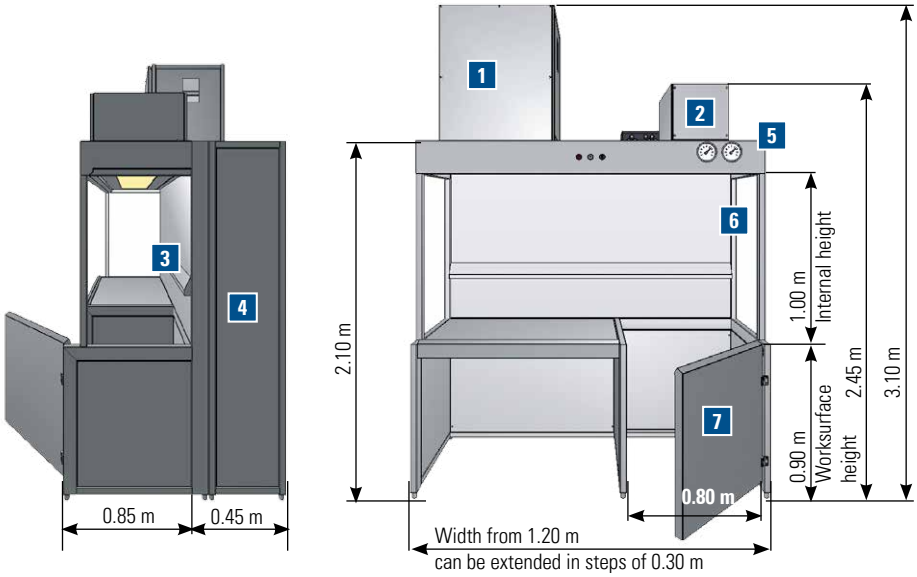
- Washing/draining basins in the worksurface
- Standing area with floor extraction, e.g. for 205 litre drums and
- ATEX-proof designs
- Filter technology in the rear wall or separate filter unit

For more information on dimensions, basic equipment and practical examples, please see pages ➡ 18–19

Premium – Dimensions and equipment

System description

The ejector technology used ensures airflows from the entry towards the extraction vents. The targeted clean air curtain provided by the ejectors, together with the air extraction technology, ensure any harmful substances are safely captured.



1 Extraction fan (optional)
2 Ejector fan
3 Extraction vents
4 Filter system (optional)
5 Filter differential pressure indicator (optional)
6 Glazing (optional)
7 Standing area (optional)

Equipment

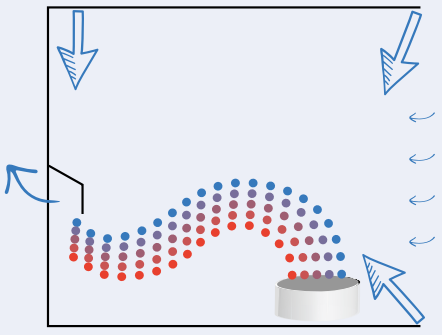
Basic equipment

- Sturdy steel frame construction (powder coated or optionally in stainless steel)
- Closed rear and side walls in steel, powder coated
- Work surface in stainless steel, corrosion free, even under intensive use
- Strong worksurface, load capacity 150 kg
- Exhaust air connection: Exhaust air connection for connecting customer's ventilation equipment or an extraction fan
- Air supply fan for supplying the ejector system
- Flush-fitting built-in lighting
- Accessible working area - no barriers or front screen
- Switch cabinet / control system

Additional equipment

- Washing / draining basin in the worksurface, with/without additional draining board
- Media connections e.g. sockets
- Glazed side panels
- Extraction fans and air extraction monitoring
- Integrated filter technology
- Fire-rated F90 underbench cabinets
- Control flap or volume flow controller
- Stainless steel designs
- ATEX-proof design
- Standing area, e.g. for 205 litre drum with integral floor extraction
- Weighing plates for scales integrated into worksurface

Containment technology



Dimensions and technical data

Premium model	External dimensions Without filter technology W x D x H* (m)	External dimensions With filter technology W x D x H* (m)	Internal height Overall (mm)	Work area dimensions W x D (m)	Work area (m^2)	Air extraction volume flow (m^3/h)	Pressure loss (Pa)
AT-12	1.20 x 0.80 x 2.45	1.20 x 1.30 x 2.45	1000	1.10 x 0.75	0.80	720	from 150
AT-15	1.50 x 0.80 x 2.45	1.50 x 1.30 x 2.45	1000	1.40 x 0.75	1.05	900	from 150
AT-18	1.80 x 0.80 x 2.45	1.80 x 1.30 x 2.45	1000	1.70 x 0.75	1.28	1080	from 150
AT-21	2.10 x 0.80 x 2.45	2.10 x 1.30 x 2.45	1000	2.00 x 0.75	1.50	1260	from 150

*without fan units

Practical examples

Work bench AT-18 Premium

- For weighing and dispensing tasks
- Standing area with additional floor extraction
- Work area with weighing plate
- Air extraction monitoring
- Folding doors with connection to the ejector system

Work bench AT-15 Premium as a weighing workplace

- Weighing powders and dusts which are harmful to health
- Effective protection for people and spaces
- Side pass-throughs for bringing in the materials to be weighed
- Entire design in high quality stainless steel

Work bench AT-15 Premium for processing preparations

- Recirculating air operation with recirculating air fan and activated carbon filter cell in ATEX design
- Recirculation airflow format monitoring
- Compressed air and water connections in the work area

Additional practical examples can be found at denios.shop/projekt

Ventilation testing in accordance with DIN EN 14175 – Part 3

VARIO Flow Premium and Pharma work benches as well as the HazMat workstations for laboratories are type approved in accordance with EN 14175-3. The technology used offers the operator the highest levels of safety.

Part 3 of European standard EN 14175 sets out the type approval methods for evaluating the safety and performance of fume cupboard airflows.

What does that mean?

DIN EN 14175 consists of the following parts:

Part 1: Terms

Part 2: Requirements for safety and performance

Part 3: Type approval methods

Part 4: On-site test methods

Part 5: Recommendations for installation and maintenance

Part 6: Variable airflow fume cupboards

Part 7: Extraction systems for high heat and acidic load (high performance fume cupboards)

Aim

The aim of Part 3 of European standard EN 14175 is to set out the type approval methods for evaluating the safety and performance of fume cupboard airflows.

The German hazardous substances regulation and European work safety regulation require that released gases or particulate material are captured completely at their point of escape or emergence, before they can have a damaging effect on health or the environment.

DENIOS Premium and Pharma safety work benches ensure with a high degree of certainty that no vapours, gases or particulate materials contaminate breathing air when handling hazardous substances (for example when dispensing, using adhesives, cleaning, preparation work or weighing etc.).

This has been proven by tests in accordance with DIN EN 14175 Part 3 “Type approval methods for fume cupboards", Section 5.4 (robustness of retention capacity), which has been valid since 2003. In addition, when the equipment is used in accordance with the intended use it ensures that no explosive gas-air mixtures are created in the inner area (this is demonstrated by an additional test in accordance with DIN 12924 Part 1, accumulation of harmful gases inside the equipment, which is no longer valid).

! Info

Type test

Design in accordance with

EN 14175-3

Safe extraction for dispensing processes

Test design

- The plate which is positioned vertically and at right angles to the front side of the equipment is moved backwards and forwards with a speed of 1 m/s.
- The plate is moved a minimum of 600 mm beyond the overall width of the equipment on each side.
- The time between each pass is 30s. The concentration of test gas is measured and recorded.
- After 60s the plate starts to move and completes six complete passes.
- The measuring signal from the gas analyser is recorded for an additional 30s.
- The test outlet is turned off and the data is evaluated.

Test procedure

- Nine sampling devices are arranged on a grid and positioned directly in front of the work bench on a level parallel to the front opening to test the robustness of the retention capacity.
- In addition, a flat, rectangular plate with height 1900 mm and width 400 mm (which can be moved in parallel to the front opening) is constructed in front of the work bench.
- During the test of the retention capacity efficiency the plate is moved backwards and forwards across the whole width of the hazardous substance workstation with a speed of 1 m/s at right angles to the front side of the equipment.
- A mixture of sulphur hexafluoride (SF6) and nitrogen (N2) with 10 % SF6 is used as a test gas.

VARIO Flow work bench (Premium model) in test set-up for determining retention capacity

The evaluated measurements were collated and listed in the test report.

The results obtained for the tests carried out confirm the excellent performance of DENIOS safety work benches - even without the customary front screen found on most fume cabinets.

VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

Explosion protection

The lowest recognised explosion limit is approx. 7000 ppm (lower explosion limit (LEL) for nonane).

The test in accordance with DIN 12924 Part 1 to find the max. concentration of harmful substances in the inner area defines a max. permitted concentration of 2000 ppm harmful substance (this means a safety factor of at least 3.5).

DENIOS safety work benches and hazardous substance workstations reached a max. concentration of harmful substances of less than 320 ppm in this test. This ensures a level of safety for the user of over 20 times the limit – way beyond the requirements of DIN 12 924 Part 1.

When used correctly, no build-up of explosive gas-air mixtures can be created!

All tests were carried out by recognised and certified test institutes.

Pharma model

Personal, room and product protection

Skilfully combined – work processes in the pharmaceutical/chemical and biotechnical industries and also in the food industry set stringent requirements for the protection of people and the environment. Comprehensive product protection is often also required in these sensitive sectors. For this reason, DENIOS developed the Pharma work bench which is specifically designed to meet these challenges.

Containment technology: VARIO Flow combined technology

This technology has been specifically developed for the protection of people, rooms and/or products: Ejector technology and laminar flow technology have been cleverly combined.

Ejector technology ensures that the harmful substances are directed towards the rear wall and are then extracted. The laminar flow equipment provides a vertical flow of high-purity clean air to the suction opening in the upstream roof area. This also ensures efficient product protection.

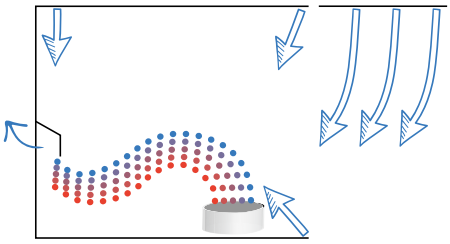
A positive effect: This sophisticated technology means that the DENIOS Pharma system uses at least 50% less air compared to pure laminar flow equipment. When used continuously, this leads to a valuable financial saving.

Safety for employees and product

VARIO Flow combined technology ensures the safety of your workforce in two ways: The vertical airflow ensures harmful substances are pushed out of the respiration area. Clean air is continually supplied to the worker, while the ejector technology reliably ensures that harmful substances are retained in the work area and removed via the extraction system.

Typical areas of application

- Sample taking
- Withdrawing samples
- Mixing
- Dosing processes
- Weighing tasks
- Dispensing tasks
- Working with product safety
- GMP/FDA compliant work

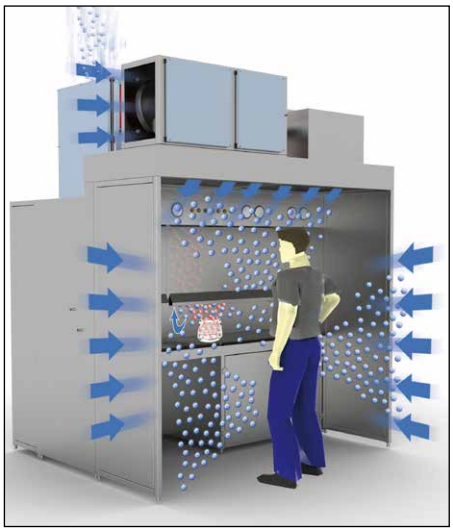


Features

The Pharma model offers the highest levels of safety and functionality. With flexibility in equipment and modular construction, made to measure solutions are easy to design.

Our engineers are always available for a meeting at your site.

Operating principle



Ejector technology is combined here with conventional laminar downflow technology, i.e. displacement flow. Ejector technology ensures harmful substances are extracted, the laminar downflow technology ensures product protection thanks to a highly filtered air supply. This means that this system uses less than half as much air as a pure laminar downflow system and is therefore the first choice, even for Ex areas.

Pharma work bench functional drawing

Info

If required, ATEX conformity in accordance with RL 2014/34/EU is available

Type test

Ausführung nach
EN 14175-3

GMP/FDA compliant if required

The Pharma VARIO Flow work bench can be supplied for use with substances with OEL/ OEB threshold values 3 and 4 if required.

Design to GMP standard

GMP compliant equipment, including the relevant documentation, is of course used as standard.

The high surface quality makes this equipment extremely easy to clean.

- **GMP/FDA compliant:**
  incl. DQ/IQ/OQ documentation
- If required available to suit **ISO Class 7**.
- **OEL/OEB 3 and 4**
- Filter systems with **"bag in bag" technology** for contamination-free filter cell replacement
- Surface roughness < 0.8 µm

For more information on dimensions, basic equipment and practical examples, please see page ➡ 24

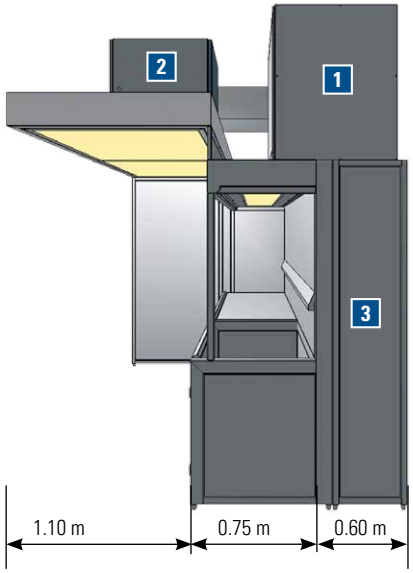
VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

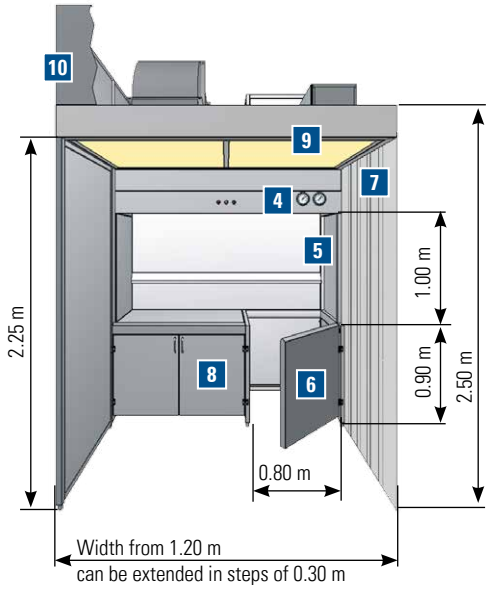
Safety work benches

Pharma – Dimensions and equipment

System description

Based on the ejector technology used in the Premium work bench range the Pharma models also use VARIO Flow combined technology to provide the required protection for people and spaces. The air supply is highly filtered, so that optimum product protection is achieved.





1 Extraction fan (optional)
2 Ejector fan
3 Filter system (optional)
4 Filter differential pressure indicator (optional)
5 Glazing (optional)
6 Standing area (optional)
7 PVC strip curtain (optional)
8 Cabinet with wing doors (optional)
9 LF blower plenum as hood
10 Room lining (optional)

Equipment

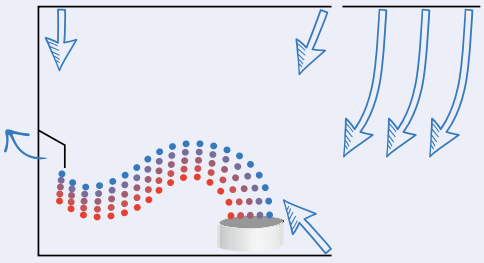
Basic equipment

- Sturdy steel frame construction (powder coated or optionally in stainless steel)
- Closed rear and side walls in steel, powder coated
- Worksurface in stainless steel, corrosion free, even under intensive use
- LF blower plenum as hood
- Strong worksurface, load capacity 150 kg
- Air extraction point at the roof, air connection provided for connection to customer ventilation system
- Air supply fan for supplying the ejector system
- Flush-fitting built-in lighting
- Accessible working area - no barriers
- Control system /switch cabinet
- Surface roughness less than 0.8 µm
- GMP/ FDA compliant design, including relevant documentation

Additional equipment

- Media connections e.g. sockets
- Side walls in safety glass
- Extraction fans and air extraction monitoring
- Filter technology in the rear wall or as a separate system, on request contamination-free "bag in bag" filter replacement
- Fire-rated F90 underbench cabinets
- Control flap or volume flow controller
- ATEX-proof design
- Washing / draining basin in the worksurface, with/without additional draining board
- Standing area, e.g. for 205 litre drum with integral floor extraction
- "Bag in bag" filter system
- Scales/weighing plates integrated into worksurface, tested for sensitive weighing processes

Containment technology



Dimensions and technical data

Pharma model	External dimensions Without filter technology W x D x H* (m)	External dimensions With filter technology W x D x H* (m)	Internal height Overall (mm)	Work area dimensions W x D (m)	Work area (m^2)	Air extraction volume flow (m^3/h)	Pressure loss (Pa)
AT-12	1.20 x 0.80 x 2.45	1.20 x 1.30 x 2.45	1000	1.10 x 0.75	0.80	720	from 150
AT-15	1.50 x 0.80 x 2.45	1.50 x 1.30 x 2.45	1000	1.40 x 0.75	1.05	900	from 150
AT-18	1.80 x 0.80 x 2.45	1.80 x 1.30 x 2.45	1000	1.70 x 0.75	1.28	1080	from 150
AT-21	2.10 x 0.80 x 2.45	2.10 x 1.30 x 2.45	1000	2.00 x 0.75	1.50	1260	from 150

*without fan units

Practical examples

Safety work bench AT-27 Pharma

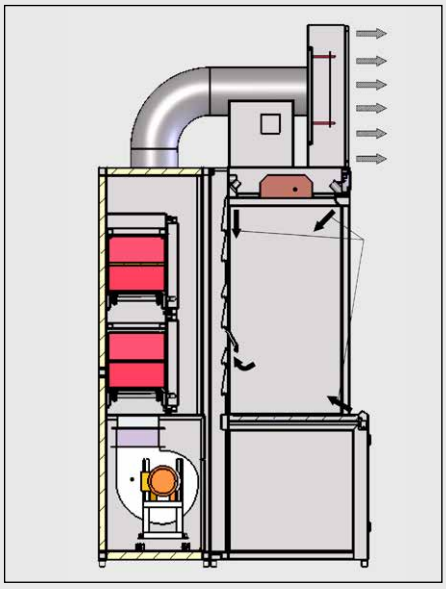
- Dispensing and sampling of active substances and vaccines
- Laminar blower plenum for highly filtered air supply
- Recirculating operation with a 3 stage filter system and a H-14 filter cell as final filter
- GMP-compliant design

AT-18 Pharma work bench as a teaching unit for sampling, dispensing and filling tasks in a cleanroom (ISO 8)

- Side standing area for a 205 litre drum
- In high quality stainless steel
- Explosion proof sockets

AT-21 Pharma work bench as a dispensing and weighing table

- Dispensing and weighing solids in a laboratory environment
- Worksurface for weighing in technical ceramic
- Standing area, for 205 litre drum with floor extraction
- Wing door with connection to the ejector system
- Optional shelf for standing area in stainless steel for smaller containers
- 3 stage filter system in the rear wall
- Recirculating operation with laminar blower plenum in the hood



Additional practical examples can be found at denios.shop/projekt

Equipment & accessories

Basic equipment		Compact model	Premium model	Pharma model
Materials and surfaces	**Frames and cladding**			
	1.0038 steel, powder coated			
	RAL 7035, light grey	✓	✓	✓
	RAL 9002, grey white	○	○	○
	Other colours	+	+	+
	Stainless steel V2A 1.4301	○	✓	✓
	Stainless steel V4A 1.4571	+	+	+
	Worksurfaces			
	Stainless steel V2A 1.4301	✓	✓	✓
	Technical ceramic	○	○	○
	Polypropylene	+	+	+
	Side panels			
	Panel design	✓	✓	✓
	Flush fitting glazing	○	○	○
	Slatted strips (PVC, dissipative if required)	+	+	+
	Worksurface design			
	Flat	✓	✓	✓
	With draining basin incl. perforated plate and drain	✓	✓	✓
	With washing basin with drain	○	○	○
	With weighing plate	○	○	○
	Front safety screen	✓	–	–
	Front screen	+	+	+
	Lighting			
	Substructure design	✓	–	–
	Flush	–	✓	✓
	Setting range			
	1-door	○	○	○
	2-door	○	○	○
	Media supply			
	Power	○	○	○
	Water	○	○	○
	Technical gases	○	○	○
	Compressed air	○	○	○
	Filter technology			
	In the rear wall	○	○	○
	Separate	+	+	+
	Explosion-proof design	○	○	○
	GMP / FDA design	–	+	✓

✓ Standard ○ Optional + On request

Further optional equipment


Area with door for larger containers


Front screen


Weighing plate

F90 HazMat underbench cabinet


Various media connections


Laminar blower plenum for recirculating operation


Lifting device


Washing brush with supply pump


Ultrasonic tank incl. temperature control

Work bench as a dosing station

Intelligent hazardous materials storage and removal

As part of an innovation project, DENIOS AG has cooperated with the OWL University Institute for Industrial Technology and the Fraunhofer IPT Project Group for Mechatronic Design Methods to develop a prototype for intelligent Hazmat storage and a smart dispensing station for hazardous substances.

The aims of the project covered the prevention of harm, limiting harm and semi-automatic HazMat dispensing. This was accomplished using a comprehensive range of sensors, which capture data for leaks, gas and fumes as well as temperature variations for example. This data is then compared with setpoint parameters, interpreted and the operator informed via various channels (directly via visual and audible signals or by a mobile device notification).

Measures are of course taken to prevent or limit any harm or damage. The dispensing station can be directly linked to the HazMat store and ensures the automatic removal and dispensing of hazardous substances with a high level of safety to ensure employee protection.

A Premium range work bench is used as the basis for the dispensing station. Efficient ejector technology ensures the employee is protected during the dispensing process. The side filling area is used to house a 200 litre drum. The table is made from high quality stainless steel. The dispensing station has an integral scale in the worksurface for weighing the dispensed liquid.

Cleaning and storage rooms

Paints contain ingredients which are harmful to health and are mostly flammable. There are therefore many requirements for these workrooms.

For a paint mixing room which was to be set up in a production hall, a mobile, turnkey solution was required. Combining a F90/REI90 fire-rated storage container with a VARIO Flow work bench created the optimum solution for this challenge.

The following protection aims were met:

- F90/REI90 fire protection inside and out
- Protection from leaked fluids
- Personal protection

The complete system with all built-in equipment was constructed by DENIOS in Bad Oeynhausen, was transported to the client's site by low loader and was able to be commissioned immediately.

Equipment needed to be developed for cleaning tools coated with resin using solvents. The system needed to guarantee the highest levels of protection from solvent vapours for the employees and also offer safe storage for the solvents. To reduce the potential risk two work areas were created:

- One work area was fitted with a VARIO Flow Compact work bench, including powerful extraction equipment
- Storage and preparation of solvents in ATEX-proof DENIOS-WFP fire-rated storage container

The containers were pre-fitted with all the necessary equipment by DENIOS, to minimise operational interruptions. DENIOS employees installed the ready-to-use equipment on site.

Compact Work bench for paint mixing and paint work, built into a fire-rated DENIOS WFP container.

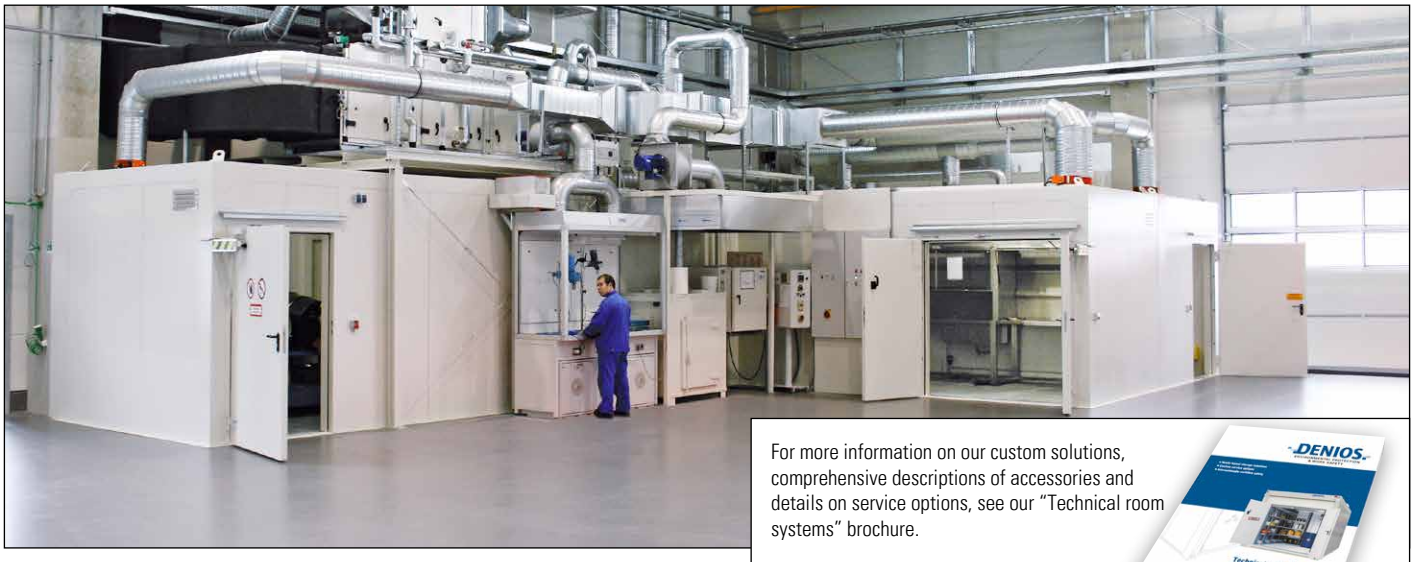
Cleanroom workplace with maximum safety

VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

A training establishment needed a cleanroom solution to make teaching the handling of hazardous substances as practical as possible. The most modern technology, in particular for safety, was needed to ensure the trainees were safe. DENIOS was the ideal specialist with experience in the implementation of complex cleanroom projects.

The challenge: Personal protection
Especially when working under production and laboratory conditions, the capture and extraction of harmful substances from breathing air is essential. Not only substance emissions but also harmful gas-ambient air mixtures can lead to respiratory illnesses or explosive atmospheres. As part of the course, the trainees learn about the behaviours needed for handling these hazardous substances under cleanroom conditions. As a service provider in the training sector, the customer lays great emphasis on safety. The installation of a new cleanroom would fill the existing gaps in handling hazardous substances. In a cleanroom, the capture of harmful substances must meet a defined particle-ambient air ratio and the number of particles must be reduced to a minimum.
Since 2009, as part of DIN EN ISO 14644-1, unified international classes have been created for these values.

The customer's cleanroom meets ISO Class 8 and therefore offers the optimum environment for handling hazardous substances. It is an autonomous system, integrated into an existing training operation. No additional facilities were needed at the site. In addition to the working area, the enclosure contains a separate personnel and material air lock.
At the centre of the work area is an ATEX-proof DENIOS work bench in stainless steel. Despite an extraction rate of 1080 m^3/h draught-free working is ensured. Operating costs for the operator are kept low thanks to the VARIO Flow technology, which has been specially developed for this application area.



Complete unit including containment technology and separate extraction equipment for the mixing processes in front of the store

For more information on our custom solutions, comprehensive descriptions of accessories and details on service options, see our "Technical room systems" brochure.

Request yours now:
www.denios.com

Filling workplace within a technical room system

A mobile solution was required for a client needing a filling station. The main challenge was that the highly flammable and toxic fluids were stored in a room and filled in a safe area.

As various sizes of containers were to be used, a barrier-free solution was selected for the work-station.

These challenges were met by using a DENIOS fire-rated storage container with spill pallet, explosion protection and an integrated VARIO Flow Premium work bench.

The fire-rated storage container was used by the customer initially outdoors, and then was moved indoors. As the extracted air was channelled into the post-combustion system, the customer was able to benefit from a significant reduction in costs, while ensuring a high level of protection for work-ers and the company, thanks to the VARIO Flow Premium System's low air extraction rate.

Test operation of the equipment at DENIOS as part of a joint product acceptance (FAT) with the client

Info

All sumps are fully compliant with HSE legislation and environmental pollution prevention guidelines

Work bench as a cleaning station with integral ultrasound tank

Time, chemicals, temperature and mechanical movement- these are the four main components for ensuring an optimum cleaning result. As temperature and chemicals, together with time, can play an important role in ultrasound cleaning, quite often emissions and vapours which are harmful to health are created during the cleaning process.

To protect workers during the cleaning process, the ultrasound tank was therefore integrated into a Premium work bench. The efficient ejector system protects workers while at the same time ensuring optimum freedom of movement, as this system does not need the conventional front screen found in many laboratory fume cupboards.

A modern touch screen control panel controls both the work bench and the ultrasound tank, including time and temperature settings.

Mixing and dispensing at the heart of production

A client required a safe solution for setting up a mixing station, required for production, at the centre of their manufacturing facilities. The mixing room was to be designed for the safe handling of water-polluting, toxic and flammable media. To guarantee the best possible levels of fire and explosion protection, the interior equipment needed to be suitable for an Ex zone.

A WFP DENIOS fire-rated storage container was used as the basis for the workroom. To allow optimum access, the room system was fitted with one-wing fire-rated doors at each short side. The technical ventilation met all the necessary requirements and was connected to the company's own in-house extraction system. The room system has sufficient space for the storage of small containers. A Premium model ejector-based capture system for harmful substances is integrated into the work room to protect workers working with the paints. The airflow from this equipment directs all emissions away from the worker, ensuring maximum safety when mixing and dispensing by hand. The air supply and extraction as well as the air exchange inside the system are permanently monitored. Comprehensive safety equipment warns the user of any incidents.

Laboratory container - safe and flexible

When working with dusts and vapours which are hazardous to health, there are generally requirements to use a technical solution in place of or in addition to personal protective equipment (PPE). DENIOS laboratory containers are ideal where flexible-location room systems are needed to extend production areas or as a separate fire area.

In this case, it was a sampling room which was used as a temporary workplace. The project required the permitted workplace limits to be observed to ensure safe handling of hazardous substances. This was achieved by integrating the hazardous substance workstation with a harmful substance capture system. The continuous supply of clean air was also important, as was the controlled air extraction.

Hazardous substance workstations for laboratories

- Basic model
- Comfort Ex model

Safety for harmful substance capture

Hazardous materials workstations protect workers when handling chemicals and ensure the prescribed workplace exposure limits are respected.

Maximum user safety
Hazardous materials workstations have targeted clean air curtains in the front area and extraction at the rear wall to ensure the most efficient capture of harmful substances.

Concept

- Ensures the prescribed workplace exposure limits are respected
- Maximum user safety
- Sturdy design in high quality, anodised aluminium profiles
- Folding baffle wall at the rear, easy to clean
- Toughened safety glass panels at the sides for a light work environment.
- High efficiency capture of harmful substances using special clean air curtain technology in the inner area, integral blower vents in the floor and head areas
- Ready for customer-side connection to an extraction system and electrical connection (230 V / 50 Hz)

1 **Air extraction monitoring** with a visual and acoustic alarm, with optional potential free alarm contact, integrated on/off switch and light switch

2 Glare-free **lighting** with energy saving bulbs, light intensity approx. 1000 lx, easily accessible, simple to change with removable cover

3 **Transparent side panels** in toughened safety glass ensure optimum light conditions in the hazardous substance workstation

4 **Rear wall and baffle wall** are easy to tilt for optimum cleaning, rear wall available in a transparent version as an option, ideal when installed in the centre of a room

5 Sturdy, torsion-resistant **design in tubular aluminium** with anodised surface and high chemical resistance

6 **Media channel** in anodised aluminium as an option, for installing various media supplies such as water, gas, compressed air and power sockets

7 Hazardous substance workstations are available without **workbenches**, ideal for fitting to existing safety work benches or with workbenches in melamine coated special materials, in stainless steel 1.4301 or technical ceramic (high resistance to many acids and alkalis)

8 **Base frame** available in heights for standing or sitting tasks, sturdy tubular design, powder coated in light grey (similar to RAL 7035), height adjustable feet, optionally with suitable facings or hazardous substance underbench cabinets

9 **Hazardous substance underbench cabinets** for fire-rated storage of flammable liquids, acids, alkalis etc.

Hazardous substance workstations for laboratories

Basic model – Maximum safety

Basic equipment

- Air supply and extraction monitoring with display (visual and audible alarm)
- Interior lighting
- Melamine resin coated rear wall
- Ready-to-connect wiring with 5 m power cable

Standard equipment for Basic model

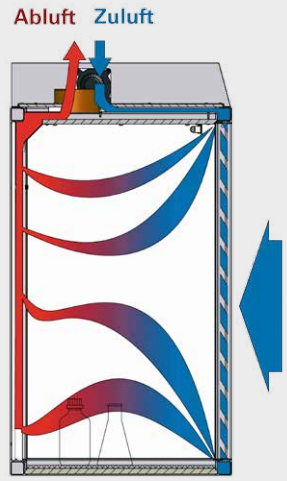
Do you already have a suitable work bench? Then Model Basic is perfect. These hazardous substance workstations can easily be fitted on to existing safety work benches.

Operation

The high levels of safety for the hazardous substance workstations are obtained thanks to the clean air curtain, which is blown out at the front edge of the worksurface and the roof.

The clean air curtain blows all hazardous vapours towards the rear wall, where they are extracted.

Hazardous substance workstation Model Basic with a base frame for standing tasks



Schematic representation of operating principle

Product features	Basic equipment	Additional equipment
■ Tested to DIN EN 14175-Part 3 (5.4.4) ■ Ensures the prescribed workplace exposure limits are respected ■ Draught-free working ■ Low operating costs for permanent operation ■ High retention capacity for harmful substances ■ Load capacity for worksurface (60 kg/m²)	■ Air supply and extraction monitoring with display (visual and audible alarm) ■ Interior lighting ■ Transparent side walls ■ Folding baffle wall ■ Melamine resin coated rear wall ■ Worksurface in stainless steel (V2A/1.4301) as a liquid-tight welded spill pallet	■ Worksurfaces in technical ceramic or melamine resin coated ■ Media connections and sockets ■ Closed sides with melamine coated plastic panels ■ Extractor fans ■ Fire-rated type 30/90 underbench cabinets ■ Fire-rated type 90 underbench cabinets with cooling ■ Base frame for sitting and standing work

Design

- Sturdy tubular frame design in aluminium with anodised surface
- High chemical resistance
- Side walls in safety glass
- Integral lighting
- Monitoring electronics as standard

Typical areas of application

Safe capture and extraction of hazardous vapours and gases.

- Ideal for dispensing, adhesive and cleaning tasks
- Avoids explosive atmospheres

Ideal for protecting you and your workers from hazardous vapours in the work room.

Ventilation

The high levels of safety for the hazardous substance workstations are obtained thanks to the clean air curtain, which is blown out at the front edge of the worksurface and the roof. The clean air curtains blow all hazardous vapours towards the rear wall, where they are extracted.

- High efficiency capture of harmful substances by special clean air curtains in the inner area
- The clean air is drawn from the work room
- Any hazardous substances present or created in the work area (gases, vapours or particulates) are safely captured

Basic model advantages

- Highly cost-effective
- Add-on unit for existing worksurfaces
- Complete range of equipment
- Air extraction monitoring

Lab equipment with three HazMat workstations, complemented by media channel and connection, sockets and additional accessory equipment.

Hazardous substance workstations for laboratories

Basic model – Maximum safety

Your individual hazardous substance workstation - in 4 easy steps

- **Step 1:**
  Choose the hazardous substance workstation. There is a choice of 6 dimensions, see the table. Media connections are noted by crosses. Media connections can only be fitted when a media base is used

  If you wish to install the hazardous substance workstation at a position which is already available, the following steps are not needed.

- **Step 2:**
  Now choose a suitable worksurface from the table. Take care to note which hazardous substance workstation is selected and which media will be worked with at a later date.

- **Step 3:**
  The hazardous substance workstation can be securely mounted on the base frames

- **Step 4:**
  The required hazardous substances can be safely stored directly in the workplace using the DENIOS underbench cabinets

Optional: Storage in the workplace in fire-rated hazardous materials cabinets in accordance with EN 14470-1.

Work safely in a light environment with transparent side walls and overhead lighting.

Media connections for individual arrangement of your hazardous substance workstation. These connections are fitted in combination with the media base.

Accessories

- Melamine resin coated worksurface
- Base frame
- Media base in aluminium
- Pair of sockets, 230 V ①
- Gas media supply ②
- Water media supply ③
- Industrial compressed air media supply ④

Model	B 1	B 2	B 3	B 4	B 5	B 6
External dimensions W x D x H (mm)	900 x 600 x 1100	1200 x 600 x 1100	1800 x 600 x 1100	900 x 750 x 1400	1200 x 750 x 1400	1800 x 750 x 1400
Worksurface dimensions W x D (mm)	790 x 490	1090 x 490	1690 x 490	790 x 640	1090 x 640	1690 x 640
Recommended air extraction volume (m³/h)	370	510	790	500	690	1080
Differential pressure (Pa)	60	110	142	100	190	240
Number of exhaust air connections (items)	1	1	2	1	1	2

Safety in Ex zones

DENIOS HazMat workstations for potentially explosive areas in Zone 1 and 2 offer the user maximum safety. Fitting electrical operating equipment in accordance with directive 94/9/EC on use in explosion protection areas reduces the risk of hazards.

With its HazMat workstations, DENIOS offers ATEX-proof products, which meet the legal requirements for explosion protected areas.

The highly effective ventilation of our hazardous substance workstations removes potentially explosive emissions both quickly and thoroughly.

Standard equipment

- Sturdy design in high quality, anodised aluminium profiles
- Side panels in toughened safety glass
- Folding baffle wall on the melamine resin coated rear wall
- Incl. worksurface in stainless steel 1.4301 (V2A), as a liquid-tight welded spill pallet
- Air supply and extraction monitoring with display and clean air curtain
- Ready for connection to customer extraction system, extraction fan available as an option
- Interior lighting
- Electrical connection 230 V/50 Hz
- The switch cabinet with monitoring electronics, which is included in the delivery, is fitted on the customer's site outside the Ex zone and cabled to the HazMat workstation.
- Base frames available as an option
- Electrical equipment meeting Directive 94/9/EC for use in explosion protection areas
- HazMat workstations for potentially explosive areas zones 1 and 2
- Ensures the prescribed workplace exposure limits are respected
- Maximum user safety
- High efficiency capture of harmful substances by special clean air curtain technology in the inner area

Info

ATEX compliant, meeting RL 2014/34/EU

Work safely with aggressive substances with DENIOS hazardous substance workstations

Model Comfort Ex	Ex 1 – 900	Ex 2 – 1200	Ex 3 – 1800
Dimensions D x H (mm)	750 x 2265	750 x 2265	750 x 2265
Width (mm)	900	1200	1800
Worksurface W x D (mm)	795 x 470	1095 x 470	1695 x 470
Height, internal (mm)	1185	1185	1185
Worksurface load capacity (kg/m²)*	60	60	60
Ventilation connection (NW)	160	160	2 x 160
Recommended air extraction volume (m³/h)	430	595	2 x 460
External pressure (Pa)	122	233	2 x 140

* max. load for static load

Industrial extraction systems

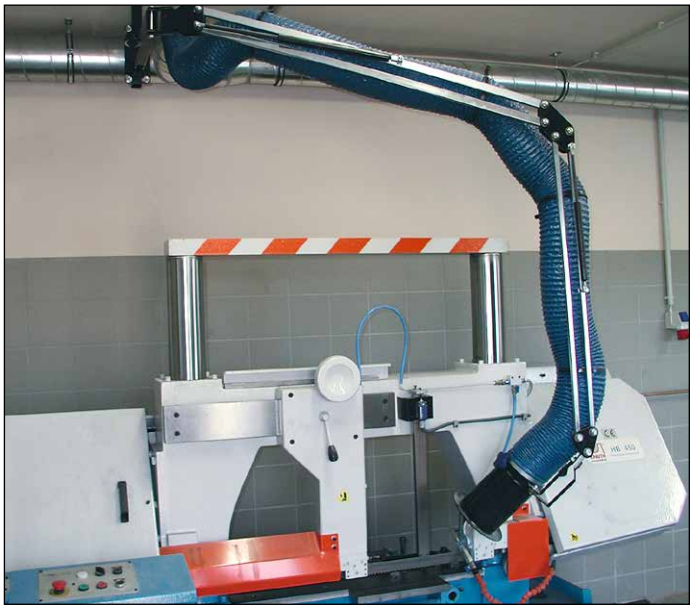
- Extraction arms
- Mobile extraction equipment
- Individual solutions

Extraction arms

- Efficient reduction of emissions of harmful substances when welding, grinding and cutting
- Areas of application: welding fumes, dusts and large particles
- Optimum positioning stability
- The flow-optimised capture hood meets the requirements of DGUV regulation 109-102
- PVC hose (Ø 160 mm) with in-built butterfly valve

Extraction arms with external joints

Extraction arm for fumes, gas and dust. The robust parallelogram frame is balanced by two hydraulic dampers and fits outside the hose.



Extraction arm length (mm)	2500	3000	4000
Volumetric flow rate min (m³/h)	1200	1200	1200
Pressure loss (Pa)	600	650	700

Extraction arms with internal joints

Extraction arm for fumes and gas with three joints in sturdy, easy to manoeuvre parallelogram design with 3 tension springs. The flow-optimised capture hood meets the requirements of DGUV regulation 109-102

Extraction arm length (mm)	2000	3000	4000
Volumetric flow rate min (m³/h)	1000	1000	1000
Pressure loss (Pa)	810	900	990

ATEX extraction arm with galvanised frame

For protection from explosive gases and dusts, which may be created, for example when weighing, dosing, mixing or sampling

- External parallelogram arm with hydraulic dampers
- Can be used in EX Zones 1/21 and 2/22
- Marking: ATEX: EX II 2D/G
- Handle and funnel in stainless steel (grade 1.4571)
- Easy to manoeuvre
- Highly stable positioning
- Highly flexible
- PVC hose, electrically conductive
- Surface resistance 10^4 Ohm
- 2 hydraulic dampers
- External parallelogram frame
- Funnel opening Ø 300 mm

Extraction arm length (mm)	1500	2500	3000	4000
Recommended volumetric flow rate (m^3/h)	1200	1200	1200	1200
Pressure loss (Pa)	550	600	650	700

ATEX extraction arm

Parallelogram arm in polished, acid-resistant stainless steel (1.4571) with hydraulic dampers. Surface roughness Ra <0.8 µm for guaranteed sterility. All pipe ends are closed off for maximum hygiene. Including wall console, Ø 160 mm.

- Technical data depending on design with galvanised frame

Stainless steel stop flap

- Tight sealing
- Stainless steel (1.4571)
- Diameter 160 mm

ATEX extraction arm with V4A stainless steel frame

Extraction arm length (mm)	1500	2500	3000	4000
Recommended volumetric flow rate (m^3/h)	1200	1200	1200	1200
Pressure loss (Pa)	550	600	650	700

Mobile extractor for fumes, dust and odours

- Mobile extraction unit with active carbon, at source extraction with large freedom of movement, improved safety and maximum comfort
- Ideal for capturing odours and gases from organic solvents
- Filtering of odours and gases from organic solvents (not suitable for toxic substances, odourless, hazardous gases or combustible and explosive gases)
- Extraction arm, 2 m, Ø 160 mm
- Ready for immediate use
- Filter housing with spring lock
- Sturdy chassis with 2 swivel castors and 2 fixed wheels
- Extraction performance max. approx. 600 m³/h
- Dimensions W x D (mm): 770 x 1145
- Noise: approx. 73 dB (A)
- Voltage: 230 V/50 Hz/0.75 kW
- Weight 73 kg

Model	OR 3	W-3 with BGIA approval	AK-3 with active carbon
Use	Capture of welding fumes and dusts (facilitates air recirculation when working with low-alloy metals)	Capture of welding fumes and dusts (facilitates air recirculation when machining high-alloy steels), carcinogenic substances, BGIA test certificate no.: 200420267 / 1140	Capture and filtering of odours and gases from organic solvents (not suitable for toxic substances, odourless, hazardous gases or combustible and explosive gases)
Equipment	Illuminated extraction hood, built-in butterfly valve	Illuminated extraction hood, built-in butterfly valve, alarm function for motor protection + filter saturation	Active carbon filter 20 kg fill capacity
Total air extraction (m³/h)	1050	1050	600
Particle filter	35 m² flame retardant	35 m² flame retardant	–
Separation efficiency	>99 % in accordance with EN 15012-1	>99 % in accordance with EN 15012-1	–

Mobile filter box Model MF-3

- For fume and dust extraction
- Version with chassis and 3 m long extraction arm
- Inbuilt noise damper
- Volume flow to approx. 1000³/h
- Inbuilt operating hour counter
- Filter cartridge: polyester with 99 % separation efficiency
- W3 certified by an independent institute
- Approved to EN 15012
- Automatic closure cap
- With automatic, mechanical and pneumatic cleaning
- Filter category: dust class M (per BGIA)
- Long-lasting filter cartridge in woven polyester fabric, filter area 13 m²

Practical examples

Safe sampling and dispensing in a separate room system

For a customer from the chemical industry, DENIOS created a unique solution for sampling and dispensing, based on its technical room system. In this dispensing room, based on a System container, samples are taken from various containers, for example drums or IBCs, and dispensed into smaller containers.

The system is fitted with an extraction arm with a flexible reach of up to 2 m to protect workers. All components inside the room system are suitable for Ex zone 1.

In addition to a washing basin, there is an emergency eye shower available to employees in the event of an incident.

Suitable heaters are also provided in addition to the extraction ventilation to create a complete DENIOS solution. The entire system is designed for outdoor installation.

Basic legal information

As part of the risk assessment in accordance with § 5 and § 6 of the Labour protection law, hazards and loads must be determined when working with hazardous substances.

The hazardous substance regulation implements the European Guideline RL 98/24/EC "Protection of workers from chemical risks". The previous Technical rules for hazardous substances (TRGS) may be used to help apply the regulations and determine the design.

The employer must determine, before an activity is begun, whether the substances concerned are hazardous or whether any hazardous substances will be created or released during the activity.

Important acronyms - explained in brief

AGW = Occupational Exposure Limit
TA Luft = Technical Instructions on Air Quality
TRGS = Technische Regeln Gefahrstoffe - Technical Rules for Hazardous Substances
OEL = Occupational Exposure Limits (Workplace threshold value for unacceptable exposure)
OEB = Occupational Exposure Band (Categorisation of substances according to toxicity)
TK = Tolerance concentration
AK = Acceptance concentration
BM = Evaluation measure, risk based

When handling hazardous materials

there is often a potential risk to employees caused by the emission of harmful substances The German AGW or TRK limits provide the threshold values for pollution in breathing air, to which an employee may be exposed when working with a hazardous substance.

In pharmaceutics, there is usually an equivalent classification of the threshold value in accordance with OEL/OEB.

Hazards to health

For low hazards and hazardous substances

Xn Xi C

health hazard | irritant | corrosive

For hazards with hazardous substances

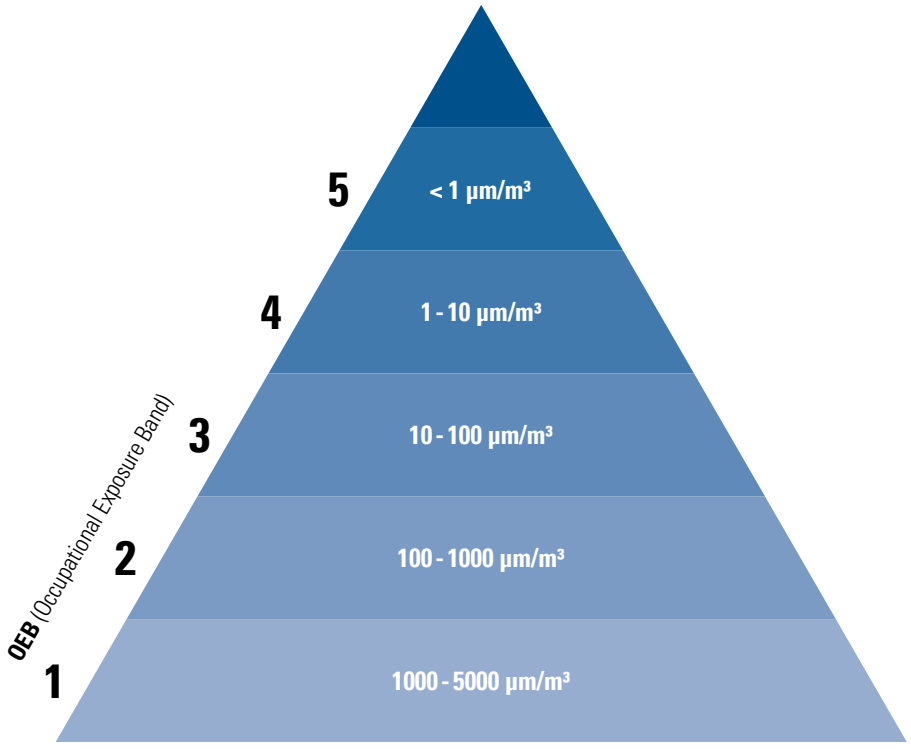
T T+

toxic

For particular hazards with hazardous substances, which are carcinogenic, mutagenic or toxic to reproduction.

CMR

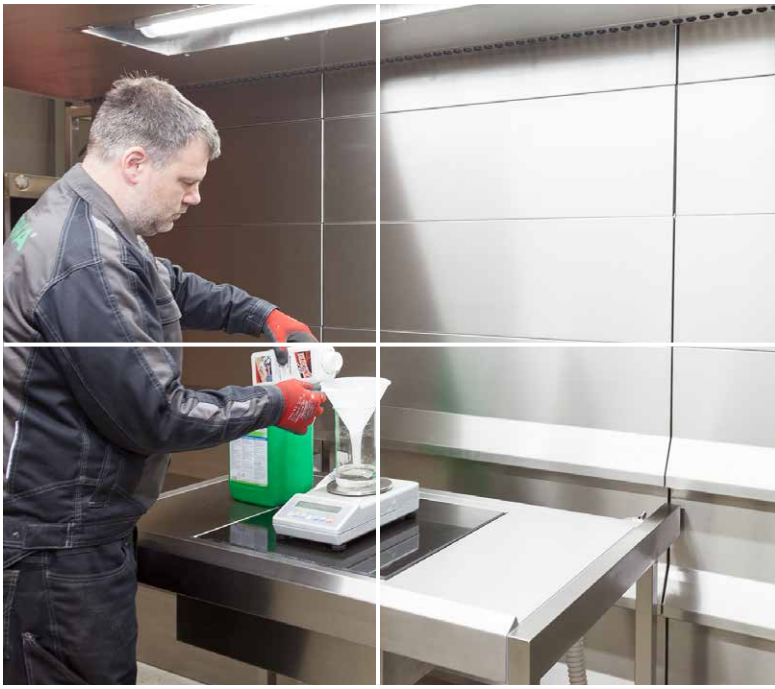
health hazard



OEL (Occupational Exposure Limit)

Free workstations

- **Compact model**
- **Premium model**
- **Pharma model**



Increased protection for workers and workspaces, combined with product protection

Various hazardous substances - differing production conditions: every production operation and production stage has different requirements for hazardous material capture. This is why DENIOS offers free workstations in three different model ranges:

- **Compact model**
- **Premium model**
- **Pharma model**

DENIOS offers a wide but extremely specialised range of ventilation designs. Professional advice from your personal project manager will help guide you to the ideal solution.

Take advantage of custom-made solutions with an optimum cost/benefit design.

The basic requirements for all DENIOS containment technology products are:

- Safe extraction of hazardous emissions, ensuring reliable protection of employees and the environment
- Low extraction volumes for permanent operation (Premium/Pharma models)
- Low noise levels
- Integration into existing room ventilation designs

VARIO Flow free workstations

Our free workstations offer enough room even for work processes needing a lot of space. Containment technology, the robust design and a wide range of equipment reflect DENIOS' high quality standards and the latest state of the art.

Choose between standard and custom dimensions for your free workstation.

VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

✓ **Personal protection**
✓ **Room protection**
✓ **Product protection**

Which Model range is suitable for your requirements - find out here:

Compact model

- Filling
- Dispensing
- Painting
- Grinding
- Washing
- Cleaning
- Evaporation

➡ **S. 46–49**
Compact free workstation

Premium model

- Dosing
- Weighing
- Handling toxic substances
- Filling, dispensing
- Washing
- Cleaning
- Sampling

➡ **S. 50–53**
Premium free workstation

Pharma model

- Sample taking
- Withdrawing samples
- Mixing
- Dosing processes
- Weighing tasks
- Dispensing tasks
- GMP/FDA conformity
- Working with product safety

➡ **S. 54–57**
Pharma free workstation

Compact model

Robust and adaptable

A cost-effective solution, DENIOS free workstations are ideal for use in tough industrial environments. The Compact VARIO Flow free workstation is perfectly designed to meet the requirements of short duration and repeated work processes. The powerful extraction technology ensures a high level of safety. Efficient ventilation ensures that your employees are comprehensively protected, even when they are moving quickly within the working area. Robust and adaptable – the Compact free workstation is an ideal solution for everyday production requirements.

Efficient capture of harmful substances

The working area is enclosed on three sides. Air is directed over the source of the emission so that it picks up airborne harmful substances and the horizontal laminar airflow directs them in a targeted manner to the rear wall.

The extraction system in the rear wall ensures an air speed of approx. 0.5 m/s over the entire open workspace cross-section.
A high retention capacity for the harmful substances produced as well as sufficient protection for the room are ensured by the volume of airflowing out of the ambient space.

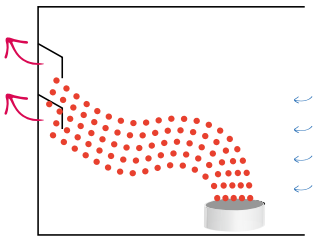
Hazardous substances are captured in a targeted manner in the working area and directed by the airflow away from the operator towards the rear wall.

Compact free workstations are designed to ensure the best flexibility possible. For this reason, DENIOS offers four different sizes.

Of course, we would also be happy to manufacture a free workstation to your specifications if none of the sizes given meet your requirements.

Typical areas of application

- Filling
- Painting
- Grinding
- Washing
- Cleaning
- Evaporation



VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

Operating principle

Compact free workstation functional drawing

The extraction technology used (horizontal extraction flow) ensures the airflows from the equipment entry towards the extraction vents. This ensures an air speed of approx. 0.5 m/s across the entire cross-section of the entry.

In this way, improved protection for both people and the room can be ensured, especially for workplaces with short operation times.

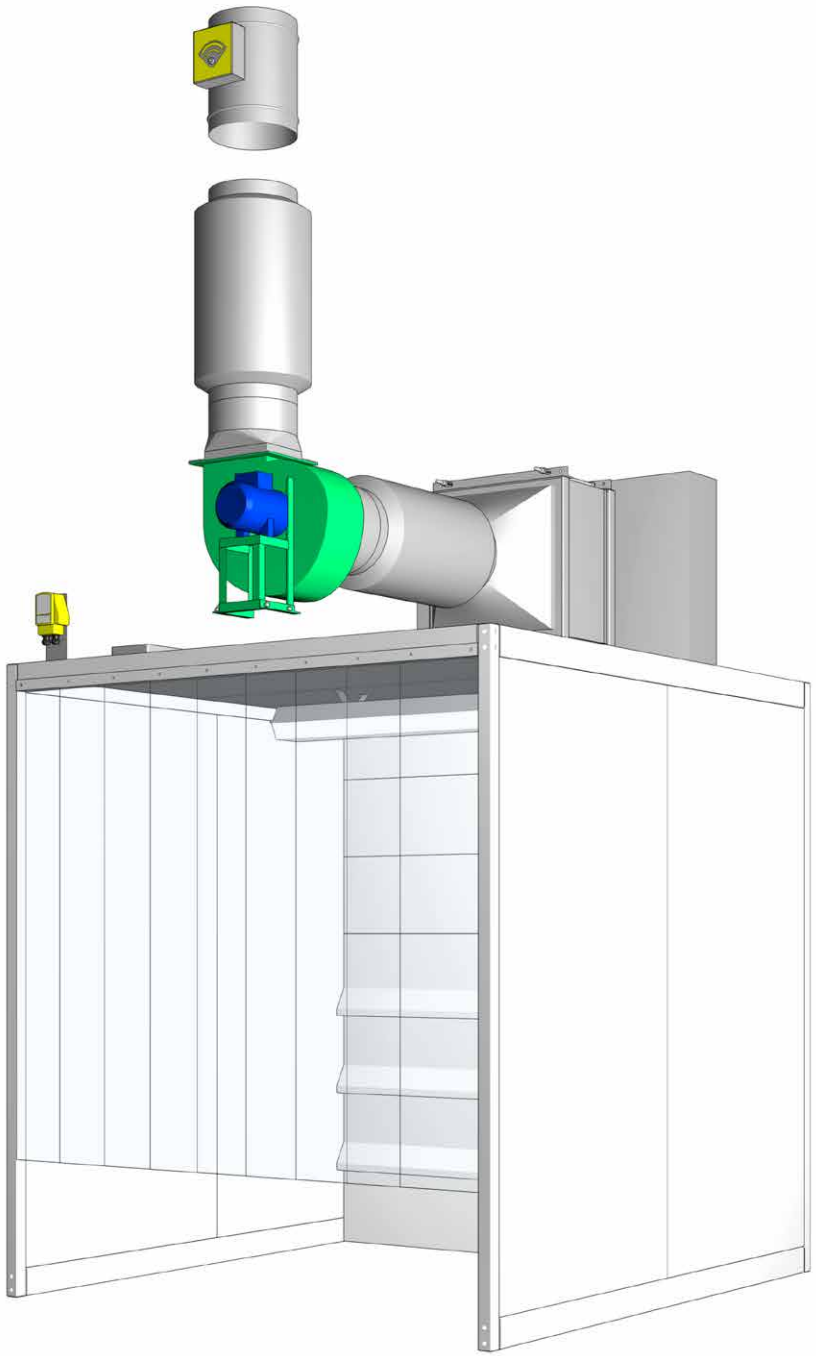
Info

If required, ATEX conformity in accordance with RL 2014/34/EU is available

Safety with System - equipment

The solid design of the Compact model includes:

- Sturdy steel frame and sheet steel design, powder coated
- Extraction connections for connecting existing extraction equipment or an extraction fan
- Integral workplace lighting
- Powerful extraction system producing an air speed of 0.5 m/s.
- Simple cleaning thanks to extraction panel in the rear wall which can be quickly removed without tooling.



Options

Extraction fans, ATEX-proof design and much more – with our wide range of additional equipment DENIOS offers the means to create your ideal free workstation.

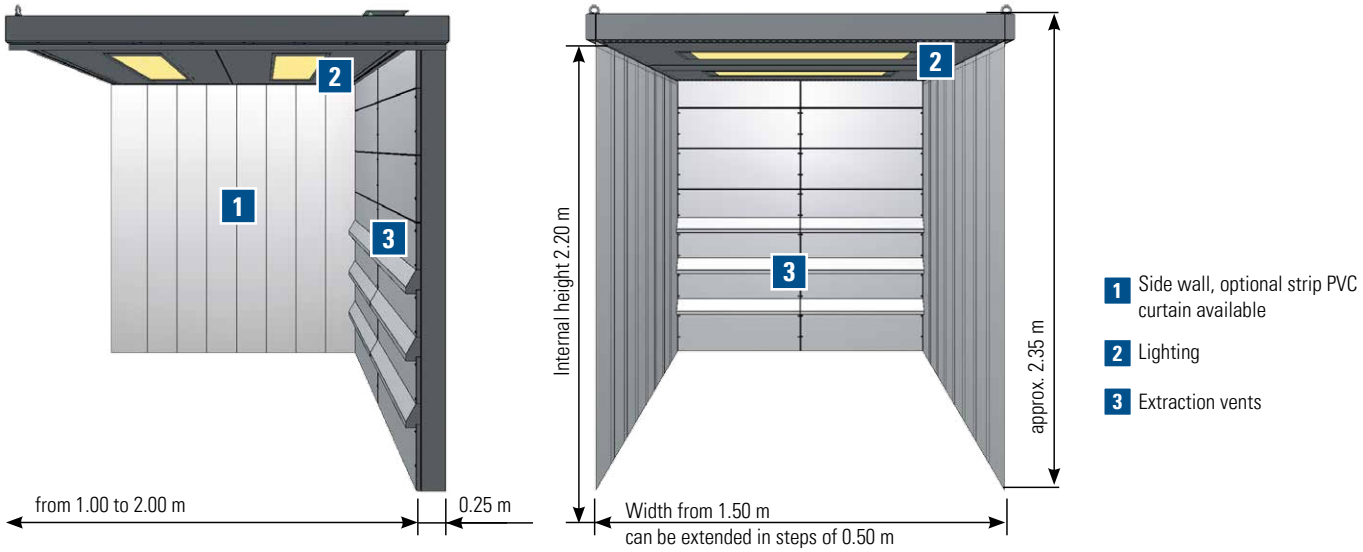
Let our engineers show you how an optimised VARIO Flow solution could work.

For more information on dimensions, basic equipment and practical examples, please see page ➡ 48

Compact – Dimensions and equipment

System description

Air in the room is sucked in over the whole of the free cross-section at a speed of 0.5 m/s. Emissions are safely captured by this airflow and directed to the extraction vents. Above the equipment, there is a connection for a fan or a customer ventilation system.



Equipment

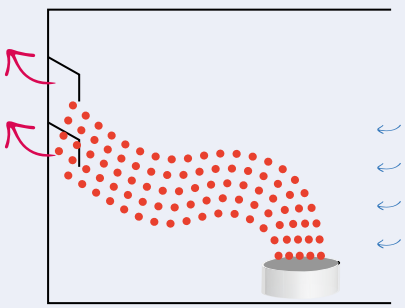
Basic equipment

- Sturdy frame construction in steel (powder coated)
- Closed rear and side walls in steel, powder coated
- Integrated workplace lighting
- Exhaust air connection for connecting customer's ventilation equipment or extraction fan

Additional equipment

- Strip curtains at the side
- Media connections e.g. sockets
- Glazed side panels
- Extraction fans and air extraction monitoring
- Control system/switch cabinet
- Integrated filter technology
- Stainless steel designs
- ATEX-proof design
- Openings for bringing in containers

Containment technology



Dimensions and technical data

Compact model	External dimensions W x D x H (m)	Internal height (mm)	Work area dimensions W x D (m)	Work area (m^2)	Air extraction rate (m^3/h)	Pressure loss (Pa)
FAP-15	1.60 x 1.25 to 2.25 x 2.35	2.20	1.50 x 1.00 to 2.00	2.20 to 4.50	5900	from 200
FAP-20	2.10 x 1.25 to 2.25 x 2.35	2.20	2.00 x 1.00 to 2.00	3.00 to 6.00	8000	from 200
FAP-25	2.60 x 1.25 to 2.25 x 2.35	2.20	2.50 x 1.00 to 2.00	3.70 to 7.50	9900	from 200
FAP-30	3.10 x 1.25 to 2.25 x 2.35	2.20	3.00 x 1.00 to 2.00	4.50 to 9.00	11,900	from 200

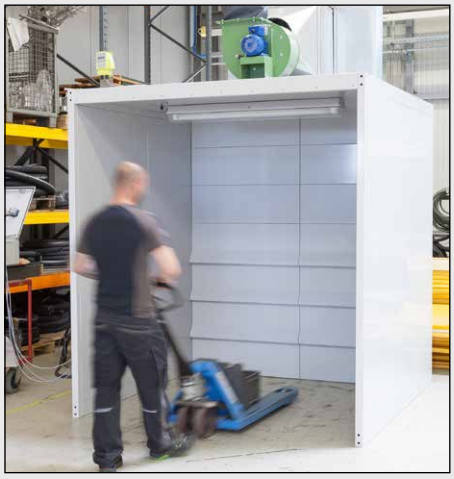
Practical examples

Free workstation FAP-35 Compact

- Protection for personnel and peripheral areas
- For dispensing and weighing tasks using substances which are harmful to health
- Ventilation system with 3 stage filter system, consisting of fine dust (F9) and Hepa filter cells (H13, H14) incl. differential pressure measurement
- Laminar blower plenum in the hood for returning the filtered air back to the room

Compact free workstation as an evaporation booth

- Protection of nearby areas from odours
- Inside the system Ex zone 1
- For evaporation and drying of cleaned components
- Extraction of explosive emissions



Free workstation FAP-20 Compact as dispensing workplace

- Protection for people and spaces
- Right and left hand side elements as strip curtain
- Props for supporting the roof load at the front
- Frame and surfaces in steel, powder coated

Additional practical examples can be found at denios.shop/projekt

Free workstations

Premium model

Safe, efficient and economical

Maximum protection with low operating costs

Premium free workstations benefit from cutting edge technology, ensuring protection and savings. The DENIOS ejector technology is ideal for ventilating large free workstations. The targeted blowing of air jets (ejectors) towards the extraction vents in the rear wall ensures that employees are effectively protected from vapours and dusts while working freely in the work area. Thanks to the draught-free work environment, even sensitive powders can easily be dispensed.

The permanent operation of ventilation equipment is generally costly. Lower extraction volumes means smaller filters. Lower costs for energy and maintenance offer a significant saving!

The special arrangement and design of the ejector nozzles in the hood ensure an intensive, stable and targeted airflow to guarantee high quality capture.

The ejector airflow is produced over the entire width of the working area so that the airborne particles etc. can be carried out of the worker's breathing air in a targeted manner.

The contaminated air is extracted from near the source of the emission and then directed further (e.g. extraction ducting, filter units etc.).

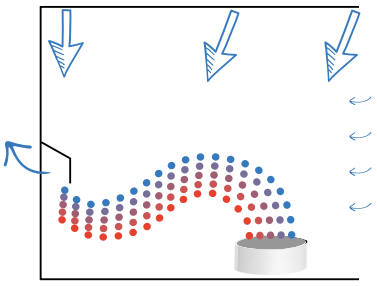
Free access to the work area isn't just for comfort. Emissions are also extracted via the shortest route possible. This is ensured by targeted channelling of the emissions to the extraction vents.

Handling toxic or harmful substances requires a high level of awareness.

Expand your free workstation with a multi-stage extraction or recirculation filter system. This does not need a large amount of space as, if required, DENIOS can integrate this technology in an extended rear wall on the free workstation - saving space and making it easy to maintain.

Typical areas of application

- Dosing
- Weighing
- Handling toxic substances
- Filling, dispensing
- Washing
- Cleaning
- Sampling



Operation

Premium free workstation functional drawing

The targeted airflow of the clean air curtain created by the ejector technology between the product, emission source and worker protects the worker and surrounding space. Emissions released, e.g. dusts or gases are captured by the clean air curtains and directed towards the extraction system in the rear wall. The clean air curtains are created by the ejector nozzles at the hood. They are designed to work perfectly together in terms of performance, shape and direction as well as speed and volume. The efficient air curtains are completely stable even when the worker moves around a significant amount during his tasks.

Despite the especially high capture and extraction performance, the Premium free workstation only uses a low volume of air compared to conventional extraction systems.

Info

If required, ATEX conformity in accordance with RL 2014/34/EU is available

Safety with System - equipment

In addition to the solid basic equipment fitted to all models, the Premium model has the following additional equipment:

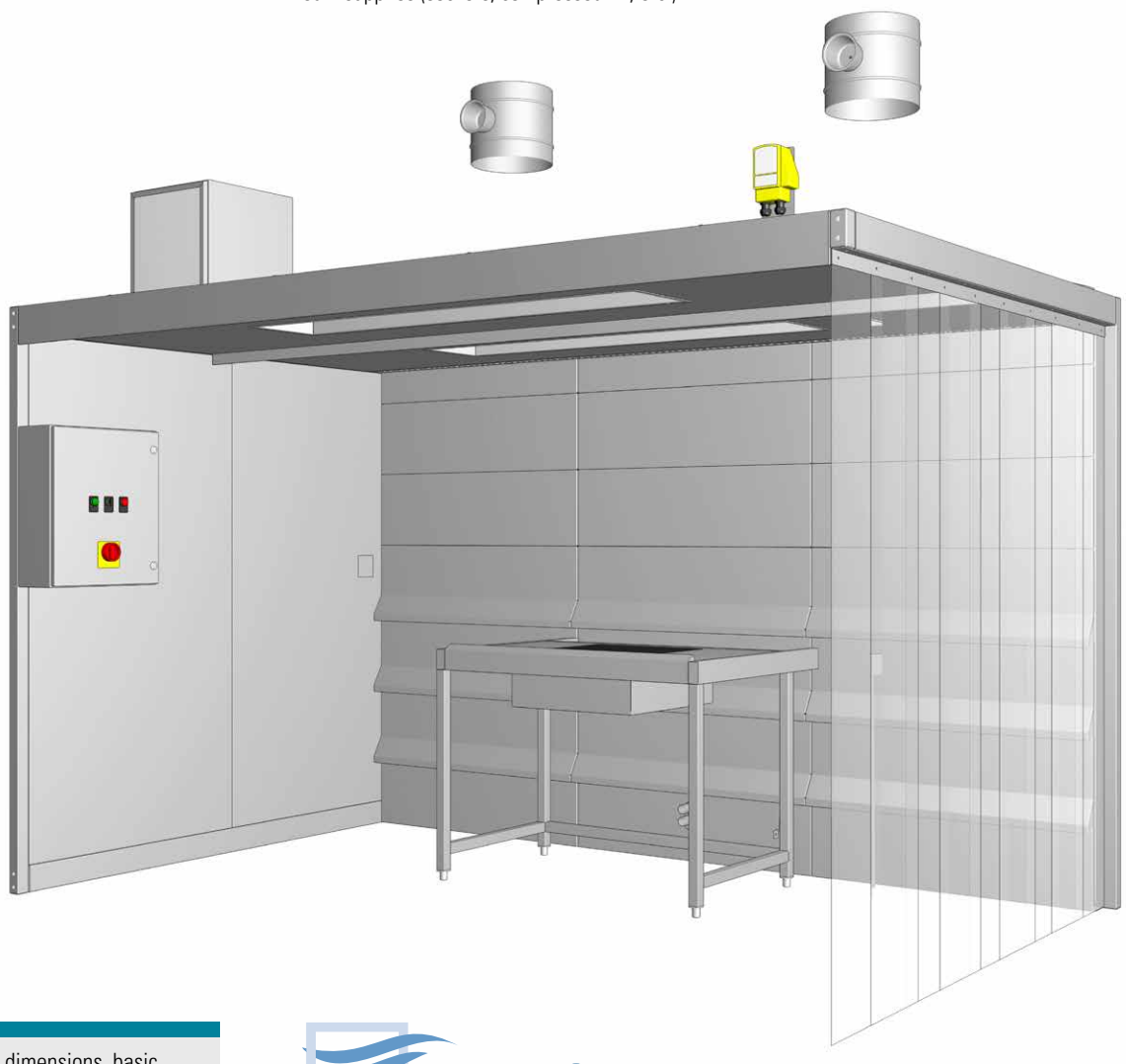
- Flush fitting built-in workplace lighting
- Air supply fan and ejector nozzles in the roof of the workstation
- Frame and surfaces in stainless steel, 1.4301

Our engineers will be happy to help advise you on your optimum VARIO Flow Premium solution.

Options

The Premium model offers the highest safety standards and has an overall design for customisable solutions. For this reason we offer a wide range of additional equipment, for example:

- Air extraction monitoring and extraction fans
- ATEX compliant ATEX-proof designs
- Side walls with safety glazing
- Filter technology in the rear wall or separate filter unit
- Media supplies (sockets, compressed air, etc.)



For more information on dimensions, basic equipment and practical examples, please see page ➡ 52

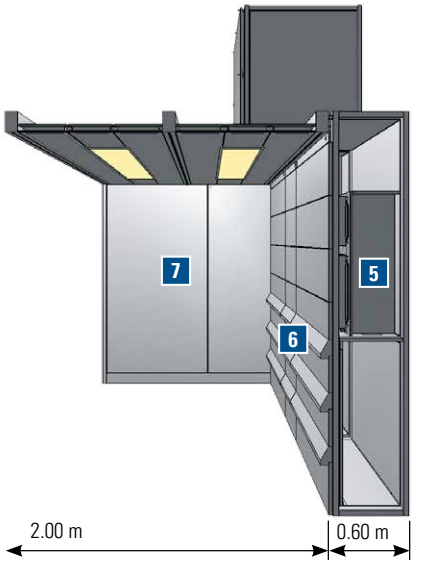
VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

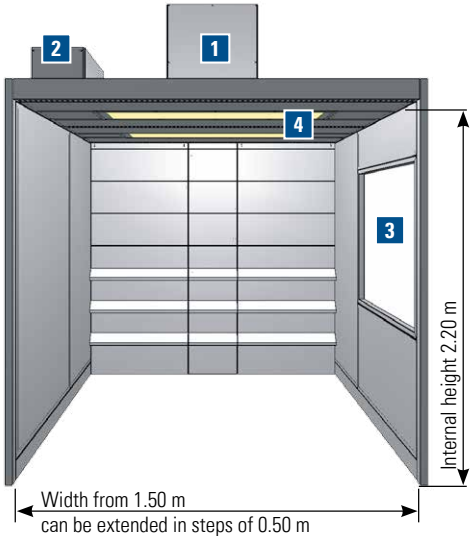
Free workstations

Premium – Dimensions and equipment

System description

The ejector technology used ensures airflows from the entry towards the extraction vents. The targeted clean air curtains provided by the ejectors in the roof area, together with the air extraction technology, ensure any harmful substances are safely captured.





1. Extraction fan (optional)
2. Ejector fan
3. Glazing (optional)
4. Lighting, flush-fitting
5. Filter system (optional)
6. Extraction vents
7. Side wall as panel or strip curtain

Equipment

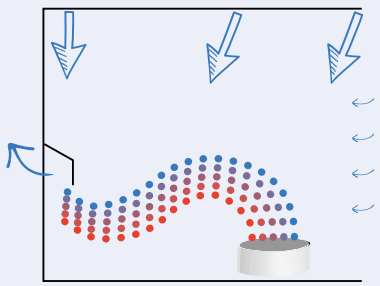
Basic equipment

- Sturdy steel frame construction (powder coated or stainless steel)
- Closed rear and side walls in steel, powder coated
- Integrated workplace lighting
- Exhaust air connection for connecting customer's ventilation equipment
- Air supply fan
- Ejector supply system
- Flush-fitting built-in lighting
- Control system/switch cabinet

Additional equipment

- Strip curtains at the side
- Media connections e.g. sockets
- Glazed side panels
- Extraction fans and air extraction monitoring
- ATEX-proof design
- Ducts
- Multi-stage extraction and recirculation filter technology, integrated into the rear wall to save space

Containment technology



Dimensions and technical data

Premium model	External dimensions W x D x H (m)	Internal height (m)	Work area dimensions W x D (m)	Work area (m^2)	Air extraction rate (m^3/h)	Pressure loss (Pa)
FAP-15	1.60 x 2.15 to 3.60 x 2.70	2.20	1.50 x 2.00 to 3.00	2.20 to 4.50	1900	from 150
FAP-20	2.10 x 2.15 to 3.60 x 2.70	2.20	2.00 x 2.00 to 3.00	3.00 to 6.00	2500	from 150
FAP-25	2.60 x 2.15 to 3.60 x 2.70	2.20	2.50 x 2.00 to 3.00	3.70 to 7.50	3150	from 150
FAP-30	3.10 x 2.15 to 3.60 x 2.70	2.20	3.00 x 2.00 to 3.00	4.50 to 9.00	3800	from 150

Practical examples

Premium free workstation for lamination work on large components

- Width 5000 mm
- Protection for people and spaces
- Extraction of emissions harmful to health when working with epoxy resins
- Either recirculation or extraction versions
- Separate technical tower incl. fan unit and active carbon filter cells

Premium free workstation for manual weighing and dispensing work for picking recipes

- Optimum protection of personnel by capturing and extracting powders and dusts
- Free workstation in high quality stainless steel, 1.4301
- For connection to an existing extraction system on the customer's site
- Work bench - also connected to the ejector system

Premium free workstation as dispensing booth

- Dispensing various chemicals from larger containers, e.g. drums and IBCs, into small containers
- Protection of employees from harmful vapours
- Suspension of the equipment's hood from the customer's ceiling
- Free access at the sides with anti-static strip curtains

Additional practical examples can be found at denios.shop/projekt

Pharma model

Highest levels of protection for people and products

In the pharmaceutical, chemical and biotechnical industries, free workstations need to meet the highest standards for protecting people and products. This is why DENIOS offers the Pharma free workstation with sophisticated containment technology, which is optimally suited to the potential hazards of this sector. The thought-through design and construction mean that the necessary hygiene and cleanliness standards can easily be met.

Optimum protection - low costs

Even the everyday handling of pharmaceutical substances requires the highest levels of care.

Optimum protection of workers and sensitive products must always be ensured. The DENIOS VARIO Flow combined technology offers first class conditions - draught-free working area with continuous clean air supply. This safe supply of final stage filtered air and the unlimited freedom of movement for your workers offer the best conditions for free-flowing production.

Advantage

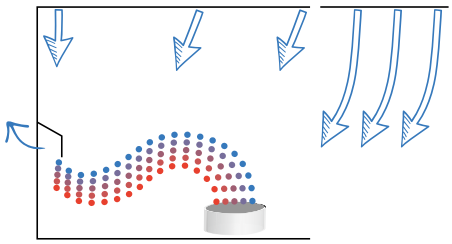
The permanent operation of ventilation equipment in cleanrooms or quasi-cleanroom areas is generally very costly.

DENIOS VARIO Flow combined technology allows you to benefit from all the savings this innovative technology brings!

Even for equipment of this size, the low energy and air requirements permit effective cost reductions.

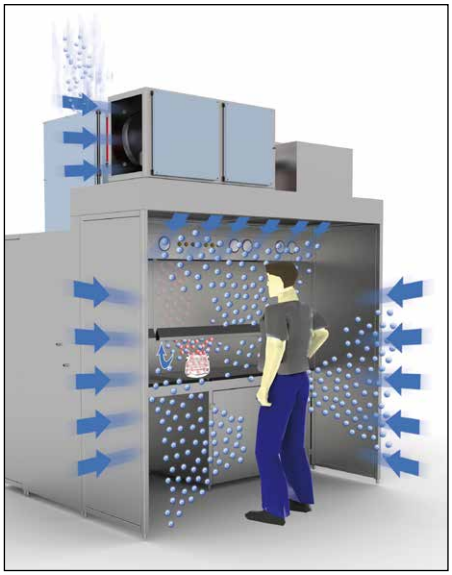
Typical areas of application

- Sampling
- Withdrawing samples
- Mixing
- Dosing processes
- Weighing tasks
- Dispensing tasks
- GMP/FDA conformity
- Working with required levels of product safety



VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

Operating principle



Pharma free workstation functional drawing

Ejector technology is combined here with conventional laminar downflow technology, i.e. displacement flow. Ejector technology ensures harmful substances are extracted, the laminar downflow technology ensures product protection thanks to a highly filtered clean air supply. This means that this system uses less than half as much air as a pure laminar downflow system and is therefore the first choice, even for Ex areas.

Info

If required, ATEX conformity in accordance with RL 2014/34/EU is available

For more information on dimensions, basic equipment and practical examples, please see page ➡ 56

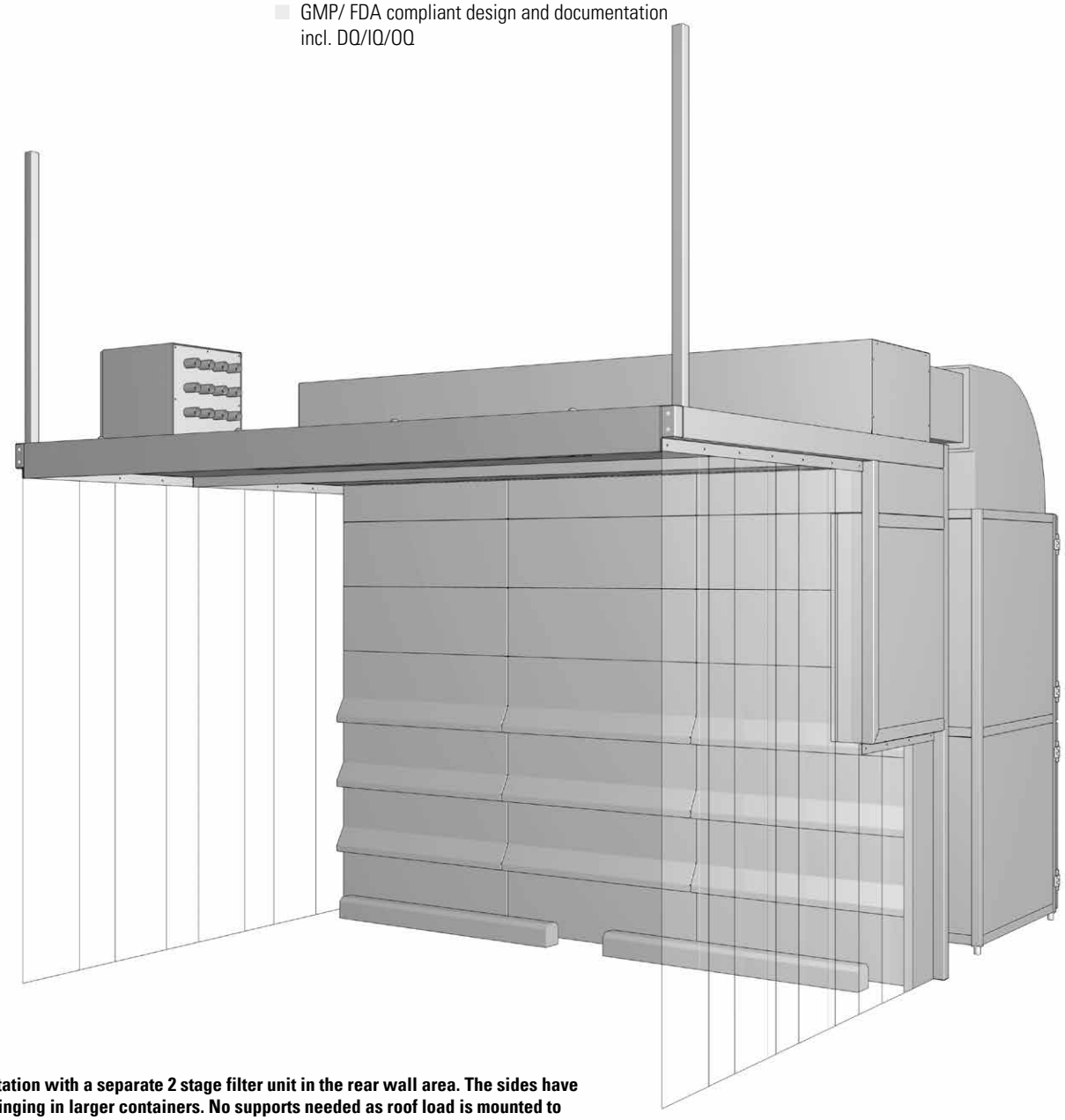
Energy-efficient working

GMP compliant equipment, including the relevant documentation, is of course used as standard. As the equipment must be regularly cleaned, the high surface quality and extraction vents which can be removed without tooling are very user-friendly and allow quick, safe cleaning of the equipment. The filters in the rear wall of the equipment can be changed from the work area, saving time and money with an ergonomic design.

Safety with System - equipment

In addition to the solid basic equipment fitted to all models, the Pharma model has the following important additional equipment options:

- Filter system with “bag in bag” technology
- Surface roughness < 0.8 µm
- GMP/ FDA compliant design and documentation incl. DQ/IQ/OQ



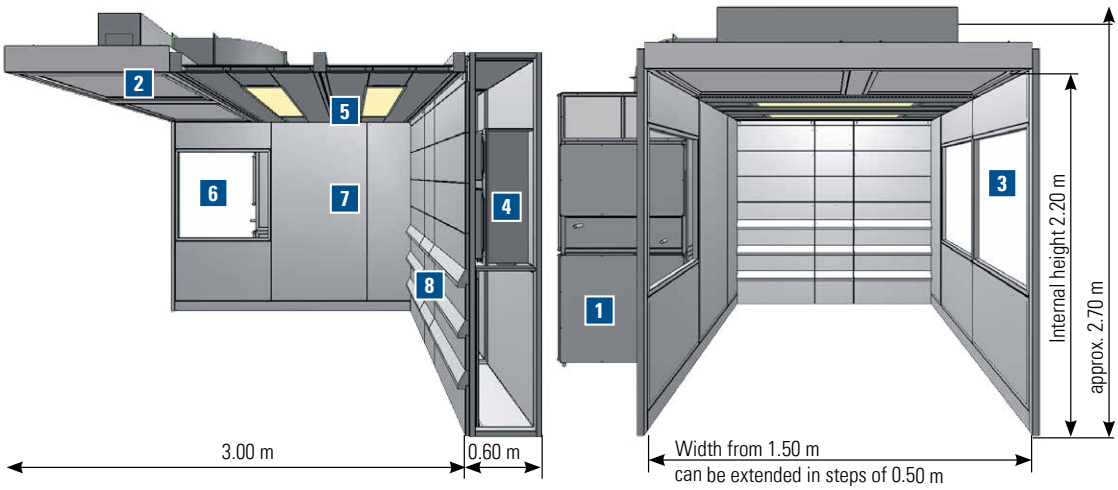
Pharma free workstation with a separate 2 stage filter unit in the rear wall area. The sides have strip curtains for bringing in larger containers. No supports needed as roof load is mounted to customer's ceiling.

Free workstations

Pharma – Dimensions and equipment

System description

Based on the same technology as the Premium model, the VARIO Flow Pharma free workstation guarantees the necessary protection for personnel and spaces. The air supplied is also highly filtered, so that optimum product protection is achieved.



1. Technical tower (optional)
2. Blower plenum as hood, to guarantee protection of personnel and products
3. Glazing (optional)
4. Filter system (optional)
5. Lighting
6. Partial glazing (optional)
7. Side elements as panels or strip curtains
8. Extraction vents

Equipment

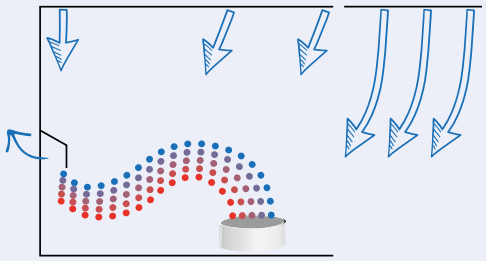
Basic equipment

- Sturdy steel frame construction (powder coated or in stainless steel)
- Closed rear and side walls in steel, powder coated or in stainless steel
- Integrated workplace lighting
- Exhaust air connection for connecting customer's ventilation equipment
- Air supply fan
- Ejector supply system
- Flush-fitting built-in lighting
- Blower plenum as hood
- GMP-compliant equipment, including relevant documentation (DQ/IQ/QQ)
- Surface roughness less than 0.8 µm

Additional equipment

- Strip curtains at the side
- Media connections e.g. sockets
- Glazed side panels
- Extraction fans and air extraction monitoring
- Control system/switch cabinet
- ATEX-proof design
- Ducts
- Multi-stage extraction and recirculation filter technology, integrated into the rear wall to save space
- "Bag in bag" filter system

Containment technology



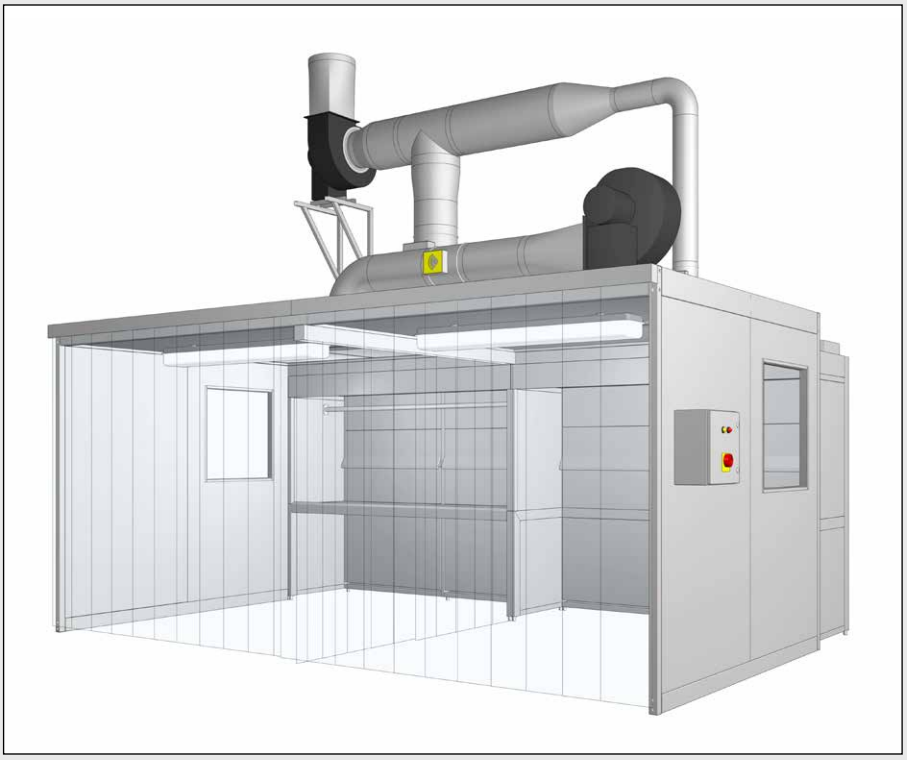
Dimensions and technical data

Pharma model	External dimensions W x D x H (m)	Internal height (m)	Work area dimensions W x D (m)	Work area (m^2)	Air extraction rate (m^3/h)	Pressure loss (Pa)
FAP-15	1.60 x 2.15 to 3.60 x 2.70	2.20	1.50 x 2.00 to 3.00	2.20 to 4.50	1900	from 200
FAP-20	2.10 x 2.15 to 3.60 x 2.70	2.20	2.00 x 2.00 to 3.00	3.00 to 6.00	2500	from 200
FAP-25	2.60 x 2.15 to 3.60 x 2.70	2.20	2.50 x 2.00 to 3.00	3.70 to 7.50	3150	from 200
FAP-30	3.10 x 2.15 to 3.60 x 2.70	2.20	3.00 x 2.00 to 3.00	4.50 to 9.00	3800	from 200

Practical examples

Pharma model sampling station

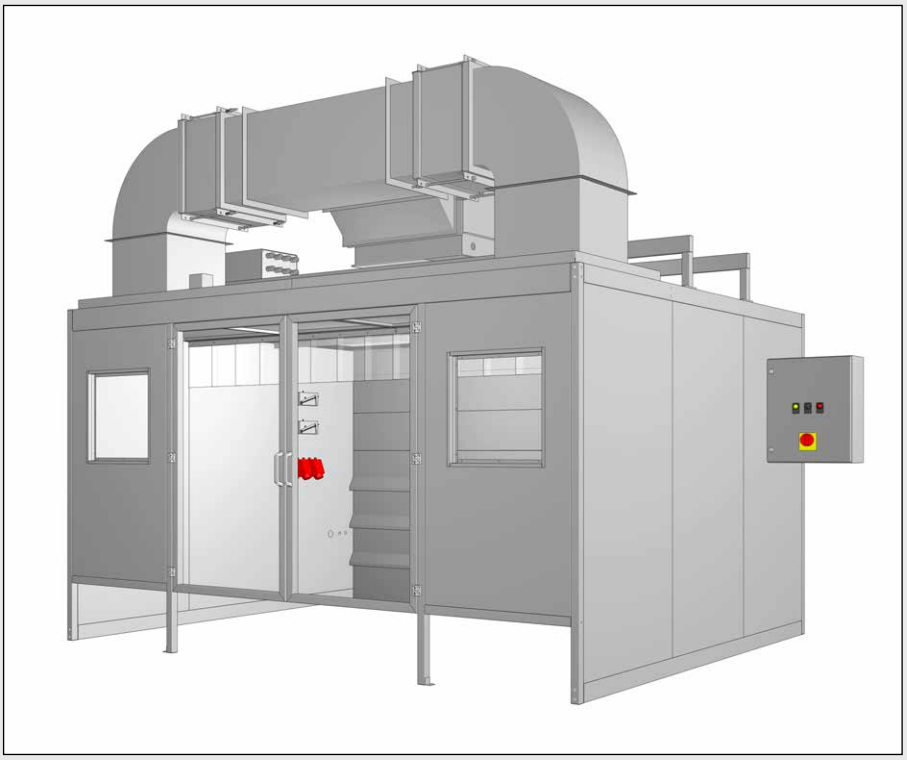
- Combination of Pharma work bench and Pharma free workstation
- Application: Sampling and weighing tasks
- Protection of personnel and periphery
- GMP compliance incl. DQ/IQ/OQ
- Provision of a highly filtered clean air supply via the LF plenum in the hood
- Multi-stage filtering of extracted air
- Front strip curtain
- Complete solution in high quality stainless steel



GMP sampling chamber for flavourings Pharma free workstation

Application: Sampling and dosing of harmful and some flammable liquids

- Personal, room and product protection
- Partial air recirculation
- Laminar, filtered air supply at the front area
- Ex zone 1 inside the booth
- Inner area fitted with washing basin and various media connections such as power, water, compressed air
- Filtered air supply via LF plenum in the roof area and via ejectors
- Areas in contact with the media in stainless steel
- GMP compliant incl. DQ/IQ/OQ



Free workstations

Equipment & accessories

Basic equipment	Compact model	Premium model	Pharma model
Materials and surfaces			
Frames and cladding			
1.0038 steel, powder coated			
RAL 7035, light grey	✓	✓	✓
RAL 9002, grey white	○	○	○
Other colours	+	+	+
Stainless steel V2A 1.4301	○	✓	✓
Side panels			
Panel design	✓	✓	✓
Slatted strips (PVC, dissipative if required)	○	○	○
Partial glazing	+	+	+
Roof load installation/suspension			
Panel walls	✓	✓	✓
Supports at front of hood	○	○	○
Roof suspension	+	○	○
Lighting			
Substructure design	✓	–	–
Flush	–	✓	✓
Media supply			
Power	○	○	○
Water	○	○	○
Technical gases	○	○	○
Compressed air	○	○	○
Filter technology			
In the rear wall	○	○	○
Separate	+	+	+
Explosion-proof design	○	○	○
GMP/FDA design	–	○	✓

✓ Standard ○ Optional + On request

Further optional special equipment

Strip curtains, dissipative

Supports, transparent strip curtain

Work bench, for high levels of personnel protection also connected to the ejector system

Partial glazing

Media supplies, e.g. sockets

Integral spill pallet

Doors in the front area

Filter technology in the rear wall

Air recirculation plenum for returning filtered air to the room

Classification of active substances in risk groups

When selecting suitable protective measures, the table may be a useful starting point. The selection of a suitable type of protective system is based on the guideline values given in the safety datasheet and the time that the worker will be exposed to the substance during the work process.

In each case substitution of the substance must be attempted to minimise risk to the worker and the environment. The following table gives a reference point for suitable systems, to ensure the OEL/OEB limits are observed.

Classification of active substances in risk groups

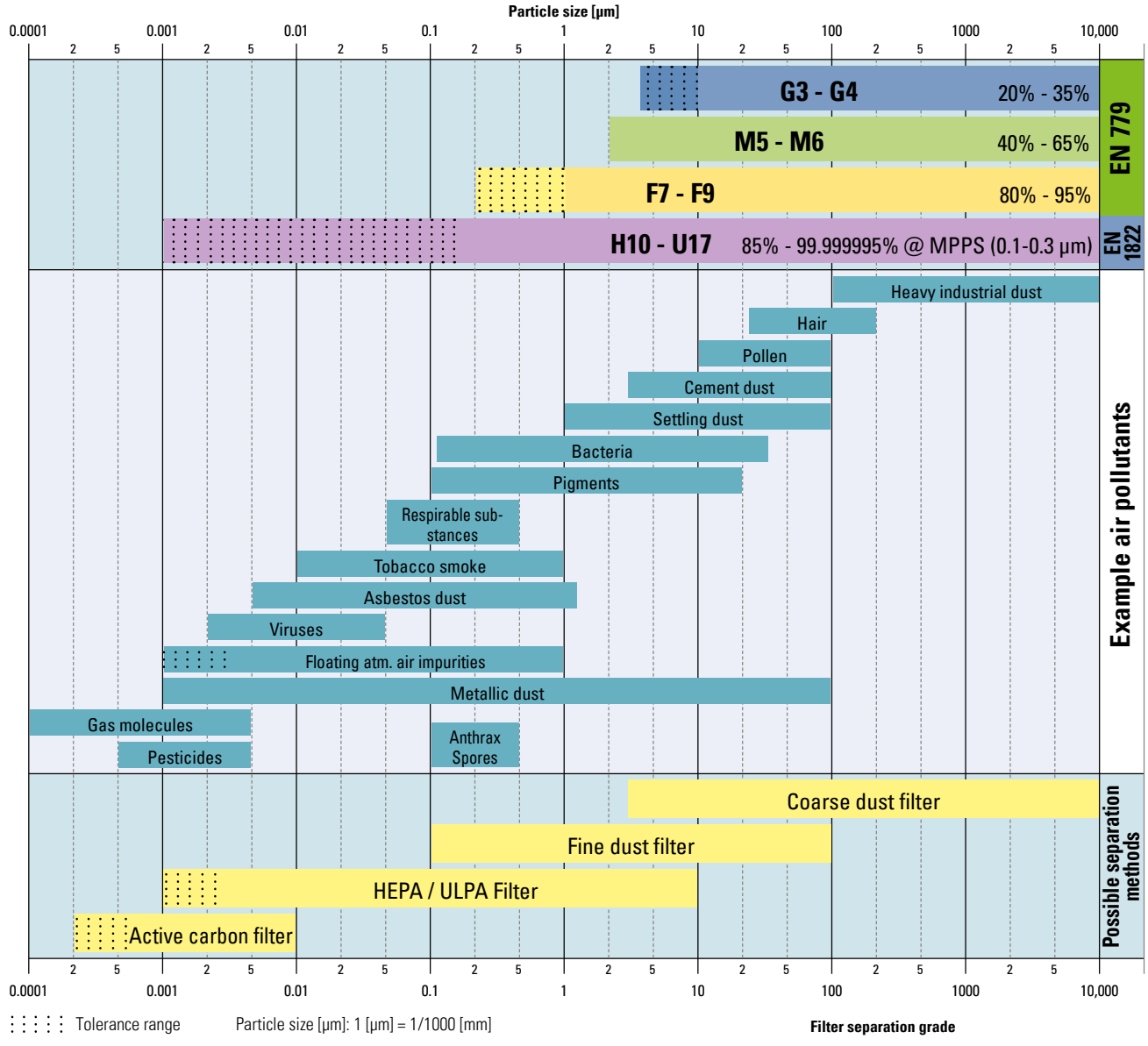
Group	Feature	system	Example substances
G 1: Substances with a **very low** potential risk	■ Pharmacological effect insignificant or not present ■ Risk to health only if ingested in large amounts ■ No labelling required as per GefStoffV ■ Low risk of sensitisation ■ Low resorption when inhaled or on contact with skin ■ No toxic effect on development and/or reproduction for doses ≤ 1000 mg/kg/d ■ Dust guide value in inhaled air > 1 mg/m³	 Extraction system with horizontal extraction (Compact type)	■ Lactose ■ Cornstarch ■ Calcium lactate ■ Calcium gluconate ■ Cellulose powder
G 2: Substances with a **low** potential risk	■ Low pharmacological effect ■ Hazardous to health ■ Irritant ■ Weak subcutaneous or chronic toxicity ■ Carcinogenic, Cat. 3 ■ Dust guide value in inhaled air 0.1 – 1 mg/m³	 Equipment with ejector technology (Premium model)	■ Chlorocresol ■ Citric acid ■ Glutamic acid hydrochloride ■ Ibuprofen ■ Pancreatin ■ Paracetamol
G 3: Substances with a **medium** potential risk **G 3a:** Affects the respiratory system first **G 3b:** Affects the skin first	■ Medium pharmacological effect ■ Toxic ■ Carcinogenic, Cat. 1b ■ May cause inheritable genetic damage, Cat. 2 ■ Reproductive toxicity, Cat. 2 ■ Moderate chronic and/or subcutaneous toxicity ■ Dust guide value in inhaled air 0.001 – 0.1 mg/m³	 Equipment with combined technology (Pharma model/LF Downflow)	■ Bromocriptine ■ Bopindolol ■ Dexamethasone ■ Ergotamine tartrate ■ Etilefrine hydrochloride ■ Israpidine ■ Lidocaine
G 4: Substance with a **high** potential risk **G 4a:** Affects the respiratory system first **G 4b:** Affects the skin first Closed fume cupboards or partly closed systems with special testing	■ High pharmacological effect ■ Highly toxic and carcinogenic, Cat. 1a ■ May cause inheritable genetic damage, Cat. 1 ■ Reproductive toxicity, Cat. 1 ■ Serious acute systemic effects ■ Serious chronic systemic effects ■ Dust guide value in inhaled air < 0.001 mg/m³	 Glovebox / Isolator	■ Cytostatics with a high potential risk, where a carcinogenic effect has been proven in humans

Source: BG-Chemie, Application Pharma / Chemical

When to use filters

These various classes of filter can be used to remove the different hazardous substances from the air. For the chemicals and pharmaceutical industries, a combination of filters using F9 for coarse and H13 for fine dusts is the current state of the art. Combinations with active carbon and particle filters are also possible.
Where very large amounts of dust are produced, many filter systems can have a self cleaning design.

In the pharmaceutical industry various classes are split into smaller divisions. The air is to be finely filtered at set air exchange rates so that the maximum permitted quantity of dust/particles in a room is not exceeded.



"Bag in bag" filter change

Filter cells in the rear wall of a free workstation

Explosion protected active carbon filters in filter frames

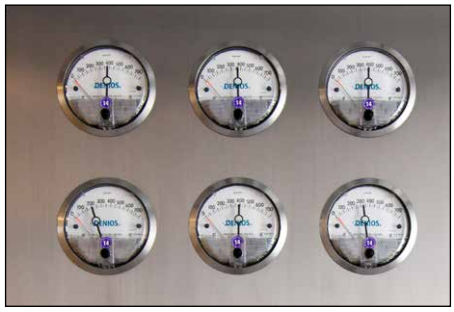
Sensors

Capture of process and sensor data by modern control systems with modern touch panel display

Connection of monitoring sensors to client's process control systems

Identification systems for employees and products

Visible and audible alarm signals



Monitoring of differential pressures, air speed and air quality, analogue or digital

Monitoring of air extraction and supply - even for Ex zones

DENIOS connect

HazMat management 4.0 with the DENIOS smart app

We're opening the door to a new world of smart products! DENIOS connect doesn't just mean access to the most important control and monitoring systems of our ventilation equipment. DENIOS connect is also the gateway to intelligent services and important information on professional solutions for environmental protection and workplace safety. Come on in!

Smart Safety Services
DENIOS connect has a host of smart services and functions for your DENIOS solution. Benefit from the advantages of HazMat management 4.0 and optimise your costs, increase efficiency and process stability!

How it works: So that connect can provide you with important information, services and additional specialist knowledge 24/7, product data, customer data and information from the DENIOS database are linked together to form a smart network.

- **Product data:**
  Sensor data, process data and notifications for your equipment are captured continuously.
- **Customer data:**
  A connection to the DENIOS SAP system enables direct access to your order data and delivery information.
- **DENIOS database:**
  Information, expertise and products are linked by our comprehensive database.

Maintenance | Condition Monitoring | Manuals Documents | HazMat management | My Services

Clean air and containment solutions

- Laminar downflow workstations
- Sampling areas
- House-in-house solutions
- Example projects

Proven quality

Denios has over 30 years experience in the manufacture of cleanroom systems for the pharmaceutical and chemical industries.

DENIOS containment and clean air solutions meet the Good Manufacturing Practice (GMP) benchmarks as well as the requirements of the US Food and Drug Administration (FDA) and meet all requirements for the protection of employees, spaces and/or products.

Typical areas of application for containment systems:

Over the last few years, DENIOS has created numerous projects for companies producing products for the pharmaceutical and fine chemical industries:

- Pharmaceutical or chemical industries
- Dosing, sampling, milling, screening etc.
- For proven containment concentrations of 100 µg/m³ – < 10 µg/m³

DENIOS offers high quality dust and solvent containment equipment, which guarantees the agreed workplace concentration levels for operators and product quality.

If you need an enclosed cleanroom environment for the safe handling of powders and solvents, DENIOS workstations offer a highly efficient solution.

Our project engineers and technicians have in-depth experience with containment equipment. All equipment is guaranteed to meet the agreed design criteria.

VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

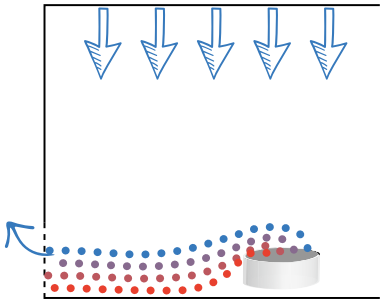
Highest levels of safety with laminar downflow workstations

Containment systems like the Laminar downflow booth and laminar downflow safety work benches protect the user from hazardous substances which can be released during manual handling of the product. Various ventilation technologies are available with a high degree of protection, where the user also can enjoy complete freedom of movement.

Laminar downflow booths are mainly used in the pharmaceutical, chemical, cosmetic and food industries. They offer excellent protection from hazardous substances. Work can be carried out under optimum conditions.

This means that productivity can also be significantly increased.

Operating principle



A clean, turbulent airflow moves vertically through the working area and is extracted near the floor. Airborne particles are captured in a controlled manner and directed away.

An underpressure within the system permanently protects the space nearby and prevents cross-contamination.

Info

If required, ATEX conformity in accordance with RL 2014/34/EU is available

VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

Laminar downflow containment workstations, operation with constant underpressure

- Full construction in stainless steel, 240s polished surface
- Laminar downflow with 0.35 m/s measured at 50 mm under the PLF screen
- Air supply area with G4 pre-filter and F9 fine dust filter with 98% efficiency
- Equipment lighting level > 600 Lux at 1.5 m above the ground
- Height adjustable workbench worksurface
- Removable grid
- Air supply via room environment

Laminar downflow booths

A laminar downflow booth is a closed system which is designed for the control of potent and non-potent compounds, for example powders or dusts, during sampling, weighing and other manual processes. Laminar downflow workstations are mainly used in the pharmaceutical and chemical industries to protect users from the harmful substances which are created when manually handling powders or liquids.

Laminar downflow booths are specially designed for containment of dust or liquids over a large emissions range. They can be fitted out so that a unidirectional, vertical airflow is present which ensures clean, safe breathing air for the worker. For downflow workstations, dust and vapours in the entire work area are suppressed and extracted.

DENIOS workstations offer the user protection when handling hazardous substances, for example when dosing, sampling and dispensing.

Typical areas of use for laminar downflow workstations:

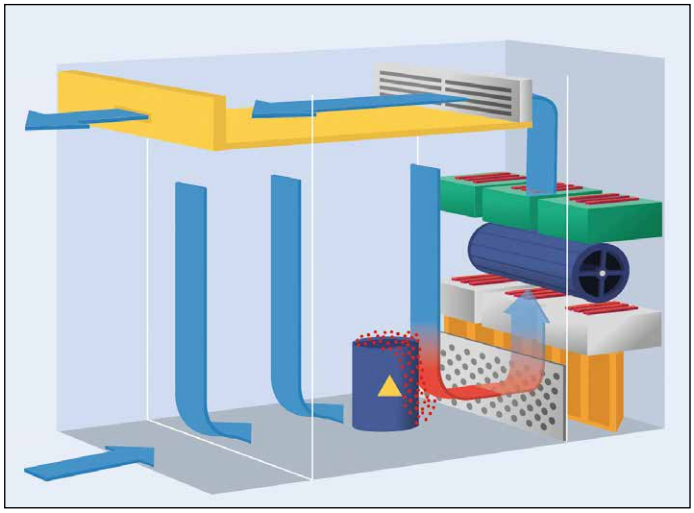
- Product dosing
- Product sampling areas
- Split workstations
- Bulk good filling / weighing
- Reactor filling
- Product emptying
- Test equipment
- Containment workstations
- Mixing areas
- Drum filling / emptying

In **recirculation airflow format systems** 100% of the air is extracted through a high performance ventilation system. At the same time, an automatic volume flow controller prevents any pressure loss as filter saturation rises.

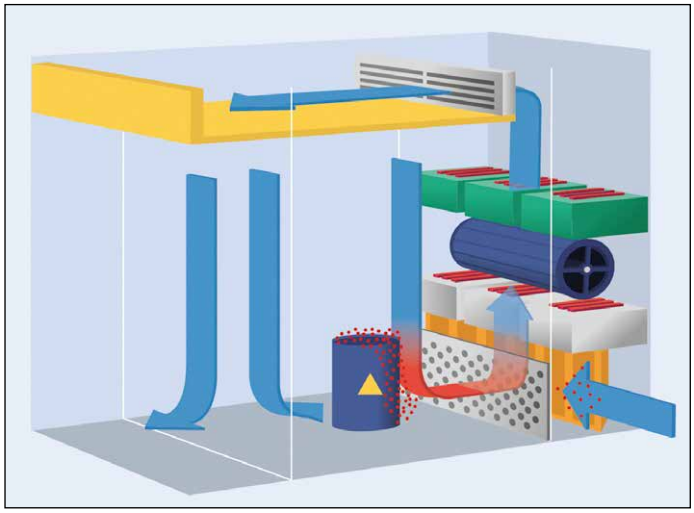
90% of the clean air is blown out at the roof area evenly over the whole safety working area and all fine dust is removed at the bottom, out of the breathing area of the user.
While the dust sinks down to a certain level above the floor, extraction grids direct the dust to the rear area of the workstation. The filter system in the rear, consisting of coarse pre-filters, fine dust and HEPA filters, filters the dust out, before the clean air is returned to the roof area.

10% of the air is directed from the filters to the outside, creating a slight underpressure. An air supply of normally 10% with a slight underpressure ensures containment. The system contains airflow regulation, motor, fans and lighting and offers easy access to the filters from the inner room.

Recirculating airflow format principle



Basic principle for **user protection** (recirculating air)



Basic principle for **user protection and product protection** (recirculating air)

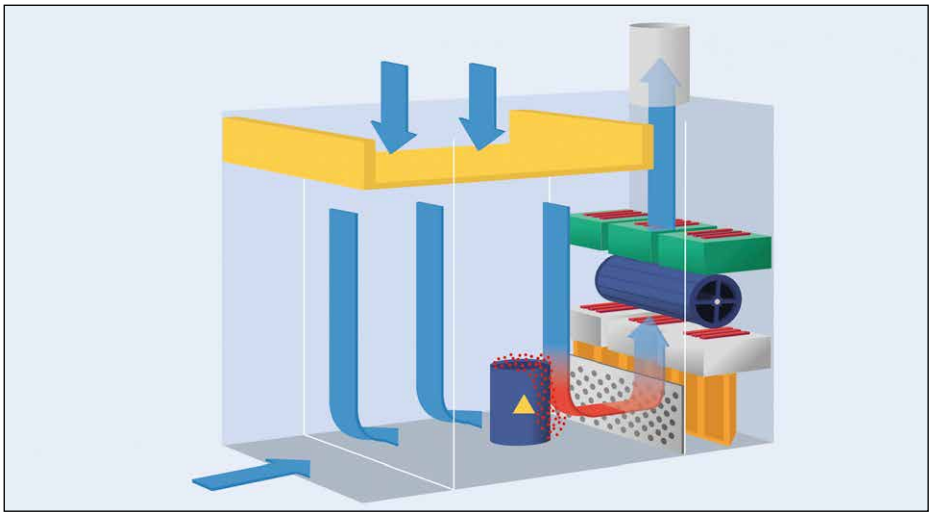
A laminar downflow single pass extraction booth is a closed system which is designed for the control of highly potent powders/liquids and solvents during sampling, weighing and other manual processes. Laminar downflow extraction workstations are mainly used in the pharmaceutical and chemical industries to protect users from the harmful substances which are created when manually handling powders or liquids.

In the **single pass extraction system** 100% of the air supply is directed through a special high performance fan and filter system, with a coarse dust pre-filter, a fine dust filter and a HEPA filter. This system produces a flow of clean, filtered air which is directed downwards, moving all fine dusts downwards out of the breathing area for the user. While the dust sinks down to a certain level above the floor, high speed extraction grids direct the dust/gas or vapours to the rear area of the workstation. The filter extraction system in the rear, consisting of a coarse pre-filter, fine dust and HEPA filters, filters the dust out, before the clean air is returned to the atmosphere. The air supply of 10% to the workstation with underpressure to the external area ensures a constant underpressure in the workplace. The equipment contains instruments, airflow regulation, motor, fans and lighting and offers easy access to the maintenance filters from the inner room.
Magnehelic differential pressure gauges offer a real time display of the status of the air supply and extraction filters as well as the air supply and extraction flows. The switch cabinet contains the control system, lighting and motor, power connections and the start/stop function. The workstation is provided with safety switches for the air supply and extraction equipment as well as an alarm indicator.

Special equipment:

- Fully automatic airflow regulation
- Extraction, fine dust and HEPA filters in safe-change filter housings for safe filter replacement
- Air supply with heating/cooling elements
- Electrical components meet ATEX Directives for potentially explosive areas

Single pass extraction operating principle



Basic principle for **user protection** (air extraction)

Info

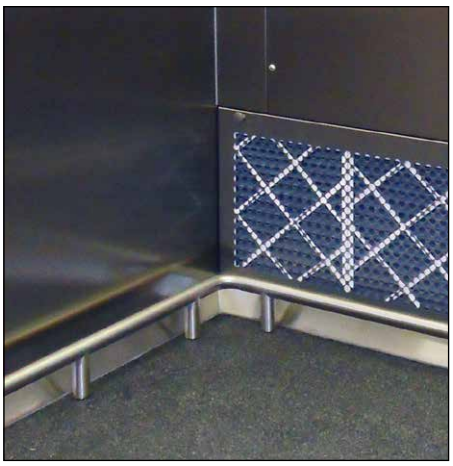
If required, ATEX conformity in accordance with RL 2014/34/EU is available

VARIO-Flow
DENIOS AIR CONTAINMENT SYSTEMS

Special equipment and accessories in accordance with user requirements

Supply connections

Turntable



Pallet protection rails / impact protection

Sprinkler head

Control systems, printers and monitors can be built in

Climate control equipment

Filter housing for contamination-free filter replacement

Visible and audible alarms

Water supply systems

Practical examples

Workstation dispensing

- Sizes: 6000 x 2700 x 3000 mm (W x D x H)
- Model: Recirculation airflow format
- Air exchange over 700 times per hour
- Airflow directed downwards at 0.475 m/s
- Additional extraction arm with separate extraction

Dosing and sampling workstation

- Sizes: 2500 x 2060 x 2300 mm (W x D x H)
- Cold water cooling coil
- Sprinkler head
- Model: Recirculation airflow format
- Total airflow: 9700 m³/h
- Air exchange over 800 times per hour
- Airflow directed downwards at 0.50 m/s

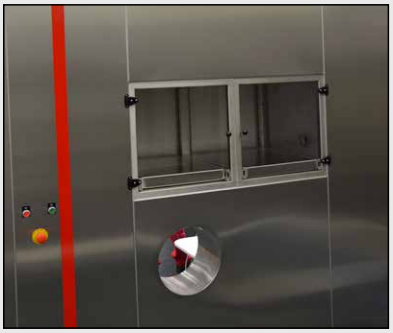
4 Laminar downflow booths

- Sizes: 3000 x 2000 x 2700 mm (W x D x H)
- Model: Recirculation airflow format
- Total airflow: 10,800 m³/h
- Air exchange over 650 times per hour
- Airflow directed downwards at 0.45 m/s
- Weigh table, 0-3100 g (+/- 0.01 g)
- Floor scales, 0-300 kg (+/- 2 g)

Practical example

Laminar downflow booth with recirculation airflow format and underpressure

- GMP compliant design
- Full construction in high quality stainless steel, 240s polished surface
- Downwards directed airflow speed of 0.475 m/s, measured at 150 mm below the PLF grid
- Airflow quality at 150 mm below the PLF grid in accordance with ISO 5
- Includes cold water cooling coil
- Air exchange over 700 times per hour
- 20% standby mode and 100% operating mode
- Control using Danfoss frequency inverter, transducer, safety relay, Photohelic airflow alarm and room lighting
- 2 x printer housings: Mounted on rails, the printer is accessible from outside with an internal, removable cover with printer label pocket
- 300 mm diameter opening for waste bag under the printer
- 3 stage filter system, consisting of G4 coarse filters, F9 fine dust filters and H13 Hepa filter cells
- Model: Air recirculation



Printer housing

Smoke test

Primary task: User protection

Target user workplace concentration < 25–50 µg/m³ over a time-weighted average (TWA) of 8 hours.

Actual maximum user workplace concentration < 0.001 mg/m³.

Isolators and product emptying equipment

Isolators

- Underpressure glovebox/isolators for continuous dosing of products from sacks
- Extraction equipment with a constant underpressure and extraction rate of 736 m³/h to the atmosphere
- Fully stainless steel design with rounded corners
- G4 filter inlet and F9 filter outlet
- Product dosing flap with viewing window and oval glove openings with gloves, door has gas dampers
- Continuous liner and waste disposal opening, diameter 225 mm
- Door contact speed > 0.35 m/s
  Glove failure >1.0 m/s
- Control of the extraction safety area via air flap
- Fluorescent lamps, light intensity in glovebox > 400 Lux

Product emptying equipment

Specially developed system for customer maximum workplace concentration. Primary dust containment for emptying and packaging dry powder products in the pharmaceutical and chemical industry.

- Product emptying funnel including diaphragm seal which self inflates outwards
- Continuous liner cartridge
- Nitrogen flushing device
- Integral weighing system
- High and low power filling equipment extraction
- Main extraction equipment with dust pre-filter mats
- Special pneumatic control panel

Practical example

Sampling equipment with material pass-through, lift, personnel air lock, material air lock with automatic conveyor belts and sampling booth – including automatic IPA disinfection area

- The design meets the specification requirements of the user for sampling large and small packages and containers
- Inner room completely in stainless steel. Double external side walls, Zintec steel, epoxy polyester powder coated
- Entry with transparent, anti-static strip curtain mounted on rails, in two sections
- Over the equipment there is a condenser with 22 kW cooling performance, which supplies the equipment with warmer air at 21 degrees.
- Operating mode control via a Siemens PLC controller

Material pass-through

- Air exchange 10 times per hour
- Air quality ISO 8
- Pallet protection rails
- Stainless steel roller conveyors
- Automatic glass sliding doors
- Intercom communication system
- Local user station for raising/ lowering the doors
- Vacuum lift for filling and emptying sacks and containers

Material air lock with spray drying system for IPA disinfection

Sampling workstation

Sampling area

- Air exchange 700 times per hour
- Air quality ISO 5
- Height adjustable table, height between 550 mm and 850 mm
- Intercom communication system
- Magnehelic differential pressure gauge for reading room operating pressure, traffic light room operating indicator, visual and audible alarm signals for room airflow, fan airflow, oxygen and IPA
- Special solvent extraction system in the rear wall of the room

Primary task: User protection

Target user workplace concentration < 10 µg/m³ over a time-weighted average (TWA) of 8 hours.

Actual maximum user workplace concentration < 0.001 mg/m³.

Material air locks

- Air exchange 10 times per hour at -15 Pa
- Air quality ISO 7
- 2 chambers for decontamination and drying
- Front area with stainless steel filling plates and folding doors with safety glass windows
- Chamber with pneumatic-lift doors with viewing windows
- Door opening 1300 mm wide x 750 mm high
- Door with switches to prevent simultaneous opening
- Automatic flat conveyor system
- Spray drying system for IPA disinfection

Personnel air lock

- Air exchange minimum 10 times per hour at 25 Pa
- Air quality ISO 7
- Air lock doors with step plates and magnetic lock
- Air locks with emergency switches
- Stainless steel dressing benches

Personnel air lock
Sealed epoxy floor. Extended wall panels to the building in self-supporting cleanroom walls, which are mounted on an inset base, 80 mm thick joining panels, epoxy coated sheet steel with PUR foam core. Ceiling in 100 mm thick panels with air distribution and inset ceiling and emergency lighting. Lighting controlled by movement sensor. Dow Corning 798 cleanroom silicon sealed joining sections. Changing room operating pressure +5 Pa.

Personnel exit to outside

Main control panel
with Siemens S7-300 PLC and
10" HMI screen

Magnehelic differential pressure gauge with marked areas for safe operation

Sampling workstation
Fully automatic airflow regulation with 50% standby and 100% operating mode for operation at -10 Pa with special extraction arm with a small radius over the table for sampling from small containers.

HMI control panel
Integrated into the sampling workstation wall. Used for showing the process and operating status as well as the availability of pallets. The control panel controls how pallets are brought in and taken away and also the operation of the pallet turntable.

Keyboard on the pull-out shelf under the main work station

Louvre grilles
Stainless steel, 240s polished surface

Pallet pass-through
Self-repairing automatic high speed sliding door with end switch for opening and closing the door

Operating alarm warning light

Pallet turntable, heavy duty stainless steel turntable set into the floor;
controlled by the HMI screen in the inner room and connected to the main conveyor system.

House-in-house systems

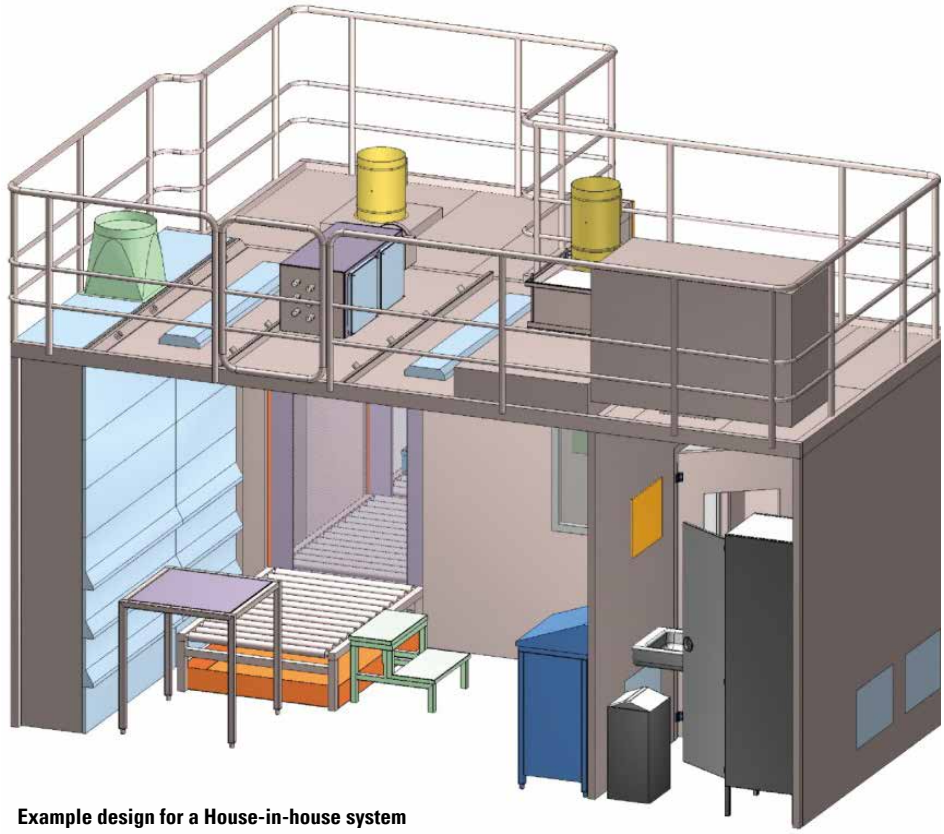
The modular VARIO Flow House-in-house systems offer almost unlimited flexibility.

Spatially separated production areas can therefore be created which meet the requirements of FDA and GMP regulations.
The implementation of perfectly aligned wall and ceiling systems, optionally alongside personnel and material air locks as well as various air supply and extraction units allows solutions to be created to meet the various cleanroom classifications.

Particular product features of the House-in-house system:

Special product features

- Self supporting system
- Material: Stainless steel or powder coated
- Smooth surfaces, therefore easy to clean
- ATEX compliant
- Various filter and ventilation systems



Example design for a House-in-house system

House-in-House system as a standalone solution. Hazardous substances are prepared and handled here under cleanroom conditions. The complete system operates with 100% air recirculation.

Recirculating downflow booth

- Operation with a constant underpressure inside the safe working area
- No pressure changes to the external area
- Air exchange over 750 times per hour
- Constant airflow directed downwards at a speed of 0.45 m/s, measured at 150 mm below the grids
- Fully automatic airflow regulation to balance out contaminated filters
- H13 HEPA filter with 99.95% efficiency
- Airflow alarm with visual and audible alarm signal
- Incl. cold water cooling coil for cold water at 15/18 °C
- Electrical switch cabinet with Danfoss frequency inverter
- Airflow total volume 13,115 m³/h

Primary task: User protection

Target user workplace concentration
< 10 µg/m³ over a time-weighted average (TWA) of 8 hours.

Actual user workplace concentration
< 0.001 mg/m³.

Practical examples

Autoclave emptying unit

- Four air recirculation room modules with a total width of 18.6 m and a safe working area of 2.5 m
- Full construction in stainless steel, 240s polished surface
- Two stage high performance filter system meeting H14 with an efficiency of 99.999%
- Airflow quality in accordance with ISO Class 5 (ISO 14644-1 and Class A in accordance with GMP Appendix 1 (GMP 2008)

Laminar downflow booth for powder applications

- Recirculation airflow format booth with final stage H14 HEPA filter system and housing for safer air exchange
- Full construction in stainless steel, 240s polished surface

Primary task: User protection

Required maximum user workplace concentration
< 0.04 mg/m³

Actual maximum user workplace concentration
< 0.001 mg/m³

Practical examples

Multipurpose high containment cleanroom

- Fully automatic airflow regulation to balance out contaminated filters
- Operating modes: 100% normal operation and 20% standby mode
- Air quality to Class 5
- H14 HEPA filter system with 99.995% efficiency in barrier filter housings for safer exchange with access via covers in the cleanroom inner wall
- Included in delivery: Cold water cooling coil
- Smoke sensor system in the lower rear area
- Removable integral stainless steel basin on rollers
- Left side wall with an opening of 800 mm x 750 mm with a vertical lift door and a sliding door as well as a user window measuring 600 mm x 1200 mm
- Removable workbench area with a 250 mm diameter opening for removal of sacks

Primary task: User protection

Required maximum user workplace concentration
< 0.02 mg/m³

Actual maximum user workplace concentration
< 0.001 mg/m³

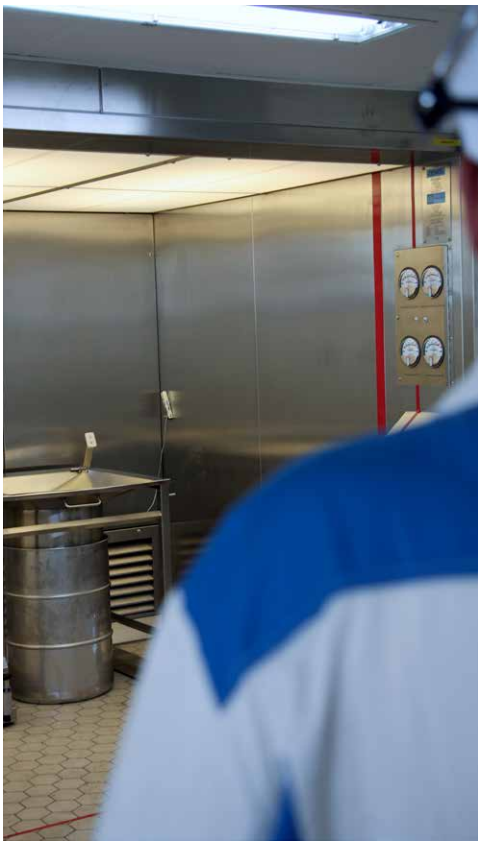
Practical examples

Containment free workstation

- Inner construction completely in stainless steel
- With air supply and extraction alarm warning lights
- Integrated low pressure vacuum connection including hinged cover. Including vacuum start-stop control panel with a green operating light
- Room rear wall with 200 mm x 60 mm stainless steel support for a max. load of 100 kg
- Fine dust and HEPA-Filter in Safe Change filter housings for safer exchange with access via covers in the cleanroom inner wall
- Dimensions: 2300 x 2200 x 2900 mm (W x D x H)
- Total airflow: 6155 m³/h
- EX, Zone 2

Practical examples

Laminar downflow equipment in accordance with FDA and GMP requirements



Emptying-containment equipment

- User windows in both side walls
- Work station includes cold water cooling
- H13 HEPA filter system with 99.99% efficiency in standard filter housings with access via covers in the room inner wall
- Removable workbenches
- Magnehelic differential pressure gauge with marked safe operating areas for reading off the airflow and filter status
- Vacuum start button on the rear wall of the room for the customer's vacuum equipment

Primary task: User protection

For maximum powder dosing workplace concentration of < 25 µg/m³

Actual maximum user workplace concentration < 0.001 mg/m³

Practical example of Laminar downflow booth

Laminar downflow roof area equipment for fitting under the cleanroom ceiling. Complete construction in stainless steel

Includes complete welded roof area construction

- H14 HEPA (99.999% efficiency) gel filter at the knife edge profiles
- High frequency T5 fluorescent lights with a minimum light level of 700 Lux at a height of 750 mm above the floor
- PLF airflow distributor grids
- Measuring points for confirmation of 100% utilisation of the filter during integrity test
- Antistatic curtains with stainless steel stiffener at the bottom

Primary task: Product protection

Approved for Zone A in accordance with GMP Annexe 1

Airflow test procedure in accordance with EN ISO 14644-3

Classification of air purity in accordance with ISO 14644-1

Laminar downflow equipment (LF)

- Fully in stainless steel with 240s polished surface fitted at the cleanroom ceiling
- Rear wall and front area include 6 fans with rotary motors, with speed controllers to ensure a uniform airflow in the equipment
- Guaranteed resistance to disinfection using hydrogen peroxide (H_2O_2)
- PLF grid, filter and lighting are easily removed for filter replacement or maintenance
- Designed for operation at 0.45 m/s at a working height of 1.0 m above the floor, for an environment classified as "Zone A".
- For operation at 0.45 m/s measured at 150 mm below the PLF grids. Test process in accordance with ISO 14644 -3
- Airflow quality Class A in accordance with GMP Annexe 1 (GMP 2008) (<0.5 and 5.0 µm/m³). Test process in accordance with ISO 14644-1 at a working height of 1.0 m above the floor
- Volume of airflow directed downwards 22,680 m³/h
- Clean air directed through climate control unit: 3000m³/h

Primary task: Protection of people and products

Required maximum user workplace concentration
< 0.04 mg/m³

Actual maximum user workplace concentration
< 0.001 mg/m³.

Airflow quality Class A
in accordance with GMP Annexe 1 (GMP 2008)
(< 0.5 and 5.0 µm/m³)

Application stories

DENIOS containment technology in the trade press

Dust driver

Since Bayer MaterialScience was rebranded as Covestro in 2015, the Leverkusen-based polymer company has been independently active in the research and production of high-tech materials, such as paints, adhesives and sealing systems, polycarbonates and polyurethanes. A major responsibility was employee protection, which the planning team were very aware of when restructuring the research area.

The intensive mixer is housed in a free workstation with wing doors, which increases employee safety and also reduces the noise level of the mixer.

When handling chemical raw materials in powder or dust form, there are increased requirements for workplace design so that employees are protected. Contact with skin or inhalation of material emissions can be harmful to the health of workers. Accordingly, Covestro emphasised the protection of employees when restructuring the research area where people would be working with powder mixtures. The main challenge was that in addition to optimum employee protection, the planned processes of weighing, screening and mixing had to be carried out in a highly efficient and ergonomic manner. These tasks were to be carried out in three working areas, which Covestro defined together with the DENIOS project engineers. Covestro chose to work with the market leader DENIOS, based in Bad Oeynhausen, to implement this project as it could meet all the requirements for these workstations.

The DENIOS solution consists of a weighing area, a screening area and a walk-in unit which houses the intensive mixing equipment. In the weighing area, chemicals are dispensed from mostly larger containers into smaller units and very small quantities are weighed. A DENIOS work bench ensures efficient capture and extraction of any emissions created.

The materials to be processed are brought into the work bench via a vertical gate at the side. A mobile, electronic lifting unit assists the user during handling tasks and when bringing in larger containers.

Ejector technology means no draughts

Another DENIOS work bench is used in the screening area where a vibration screening machine is fitted. This work bench has no worksurface and is fitted with a double swing door. The weighed substances are screened in this area. The work bench also captures any emissions created during this work step using ejector technology and extracts them via the rear wall. Both safety work benches are from the Premium range and are designed in accordance with Part 3 of EN 14175. This section of European standard EN 14175 regulates the type approval methods for evaluating the safety and performance of fume cupboard airflows and their retention capacity.

Special nozzles at the front edge of the worksurface and at the roof direct the air jets, or ejectors, towards the extraction vents in the rear wall. The airflow created blows all vapours and dusts towards the rear wall, where they are safely extracted. In this way all emissions are safely removed with the minimum air requirement. The ejector technology is designed for processes which require a draught-free environment.

The intensive mixer which is used in the last work step is housed in a DENIOS free workstation with wing doors. The previously screened materials are mixed in this area. Dusts can be created during this process which can swirl around in the environment. Like the safety work benches used in the weighing and screening areas, the booth is used to ensure safe extraction of these emissions. The doors at the front not only increase worker safety, but also reduce the noise level of the mixer at the same time.

Both the safety work benches and the free workstation are connected to the customer's extraction system and can be operated separately thanks to special control systems. In order to meet the high quality requirements in the research area at Covestro, all three systems are fully manufactured in stainless steel.

Covestro has benefited from DENIOS' many years of project experience in containment technology and the capture of harmful substances. The complete work process has been seamlessly installed in the newly restructured research area and is delivering numerous benefits for the users and operator alike. In addition to the implementation of this project, DENIOS engineers also coordinated with other services to ensure a complete project could be handed over as an all-in-one solution. While ensuring safety for the actual workers, an optimum solution was created which allowed the various work steps to be performed efficiently and ergonomically. DENIOS also created a standby function for Covestro, to help save energy. Despite ensuring effective harmful substance capture, no unpleasant draughts are created for the user which could cause materials to swirl around - an important safety aspect when handling powders and dusts on a daily basis.

Protecting people first

Premium and Pharma safety work benches are suitable for handling substances with OEL 3 and 4

In many areas of the pharmaceutical and chemical industries the use of toxic, highly toxic or even carcinogenic substances in a high risk class are part of everyday operations. The previously available solutions for handling these substances (gloveboxes etc) made working difficult however. The development of a new set of solutions was overdue.

The health risk of substances is split into various classes in accordance with the BG Chemical guidelines. A substance in Group 1 with a very limited risk potential such as lactose or cornstarch may, in accordance with this legislation, be present at a level of > 1 mg/m³ air. In one day a quantity of 1 g per kg of bodyweight may not however be exceeded. These values are already reached with simple extraction.

Due to the maximum permitted values in breathable air, the substances in Groups 2 to 4 require safer systems which can reliably ensure these values. The value per m³ of air which may be reached, is called the OEL or OEB value (Occupational Exposure Limits - workplace threshold value for unacceptable exposure or Occupational Exposure Band - categorisation of substances according to toxicity).

Especially with regard to the new classifications of substances in accordance with CLP/GHS, these safety scenarios will become more stringent in the future. Many substances will be classified at a high level according to these regulations. Substances can be encountered today which are categorised in accordance with the HazMat regulations as sensitising and in accordance with the CLP as toxic. Equally, a few toxic substances are grouped in the list of CMR substances (carcinogenic, mutagens, toxic to reproduction). New classifications even recognise a Level 5 for highly effective, extremely toxic substances, for which less than 1 µg/m³ air is permitted. From OEL 3, in addition to a highly powerful extraction system, personal protective equipment (PPE) is generally also required such as e.g. wearing respiratory and skin protection to ensure that the values required can be safely met. The alternatives to PPE are hereafter only enclosed systems such as isolators or gloveboxes.

Starting point
For equipment with a high throughput, such enclosed applications are indispensable and are accepted. It's difficult however when several different substances, containers and quantities are handled, for example in the laboratory. An enclosed system makes no sense here, especially when you are generally working with harmless substances instead of critical substances. For this reason, various tests on extraction systems were carried out at our customers' request. We aimed to find a solution, which upgraded an open extraction bench with the addition of barriers in order to meet the requirements for handling up to OEL 4. GEOTAIX – Umwelttechnologie GmbH in Würselen, Germany was commissioned as an independent measurement body.

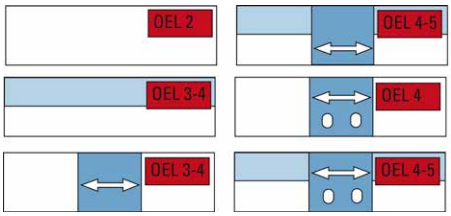
Test method
The measurement needed to meet 2 basic criteria:
1. Practical range of tests
2. Reproducible data

As the measurements could not be carried out in a cleanroom (Class A was required), they were carried out in a normal environment. Lactose monohydrate with a density of 1.525 g/cm³ and an average particle size of 48 µm was used as a test medium. The lactose was continually dispensed by a worker during the practical range of tests. Two measuring probes collected all particles from the air to the left and right near the worker. A third probe was located near the worker's face. The lactose was then separated from the filtered dust and weighed to prove the values obtained.

Test equipment construction

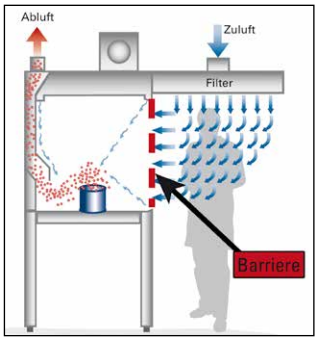
The photo shows the worker carrying out the lactose dispensing process using gloves in the barrier. The extraction table operates using the well-known ejector principle, which is accepted for working with substances up to OEL 2 as the state of the art. The barriers were put in place provisionally and the measurements carried out. In addition to various horizontal and vertical barriers and combinations thereof, various extraction airflows were also tested. As the results were only available after a couple of weeks, strategic planning and experience-based consideration was vital. The data available at the end exceeded even the expectations of the participants.

Results
A simple horizontal or vertical screen was enough to make the jump to Class OEL 3. Increasing the volume of air increased performance to Class OEL 4. The barrier with gloves as shown was suitable even with low air volumes for Class OEL 4. The combination of 2 barriers with a large air volume was potentially suitable for the highest OEL Class 5.



Test set up

OEL 5 for an open system would only be used in exceptional circumstances. For the other levels a simple and user-friendly design was created. The substances to be worked with can be freely brought into the work area and then safely worked with. As the barriers do not need to be stiff, the worker can also move around during the work process. Since the barriers were fitted to an existing system, the equipment could be operated without them, if, for example, less hazardous substances were to be worked with. Existing equipment could also be retrofitted. The individual design of the barriers can then be adapted to suit individual requirements, for example easy cleaning, dissipative, hinged etc. If products are processed in the working area which need to be protected from the ambient air, a laminar flow plenum with filter can be used in front of the extraction area. The air supply which is now extracted from the table is very clean and then ensures optimum product protection. This means a complete solution for pharmaceutical applications can be created.



Extraction table with product protection

Conclusion
Using suitable barriers for ejector technology equipment, e.g. safety work benches from the Premium and Pharma ranges, even highly effective substance can be simply and safely handled in open systems. The numerous solutions and the use of equipment without barriers offer a highly flexible area of application.

"Recirculation Booth" protects BASF-Scientists - Safer and more efficient working

The catalyst research department at chemical company BASF in De Meern, Netherlands, recently acquired an impressive seven metre wide stainless steel laminar downflow booth with air recirculation. The new equipment made working less cumbersome, with multiple extraction points, and also more efficient. "Starting with a clearly defined set of preferences and requirements, and with the freedom to put these together as we saw best, we developed this booth to be exactly tailored to this research team" explains Sander Rüpp, from the manufacturer DENIOS.

"Catalysts make chemical processes more energy efficient and more selective. We produce these products at our site in De Meern, but we are continually looking to find the right catalyst for existing and especially for innovative applications."

Dr. Rob Gosselink, chemical researcher and Research team project leader alongside colleague Dr. Esther Groeneveld, explains that BASF mainly works with powder-format catalysts and had decided to opt for a Downflow Recirculation Booth. We chose this solution so that our workers and the environment are protected when we are working with these powders on a large scale." Gosselink stresses that those working in the laboratory and surrounding areas were safe at all times. "In the laboratory we have workbench models for powder extraction, where we can safely work with small volumes. For larger volumes we had various extraction hoods up until now, which were connected to the existing laboratory extraction system. In addition, our workers had to take many extra precautions before they could begin work. This was really limiting." Now extraction is more or less automatic and therefore much simpler and quicker, so more time is available for the actual research work.

"No draughts and no noise - that's quite impressive with an air exchange speed of 35,000 m³/h."

"As we are dealing with solid particles, we can filter the extracted air and return it to the booth, which is interesting from an energy saving point of view," comments Rob Gosselink. Extraction arms are also installed in the booth which are connected to the existing laboratory extraction system. The extraction arms are mainly used for the extraction of any (aqueous) vapours and gases which are created during certain processes such as powder drying. "We don't recycle this air", says DENIOS Sales Manager Sander Rüpp. Groeneveld explains, they are looking hard into how the booths can best be made more sustainable. "It's not just about having enough extraction arms, but the dimensions of the booth and the electrical equipment also have a large role to play. As with innovative research and development processes, you always need to take into account that the scientist may perhaps work with other equipment with different dimensions at a later date."

Preferences aren't standard

DENIOS was awarded the contract after an invitation to tender to which three manufacturers responded. Alongside an attractive price, it was a deciding factor that this manufacturer already had a good track record with BASF and was prepared to contribute ideas right from the start. Rüpp continues: "We tailored our offer to the preferences and requirements of the research team." "It was a long way from a standard offering", adds Gosselink. "We needed a solution that was fully customised. A booth with as much useful area as possible within the limited space available in the research hall. DENIOS was able to deliver this within the six month timeframe required by BASF, starting right from the initial contact. This also included the tendering phase and securing finance. Rüpp comments: "We had a commercially ready product, to which we just had to fit equipment. We don't have a standard booth. We always manufacture this type of product according to the customer's requirements, to the nearest millimetre. In this case our production site in Great Britain manufactured the 7m wide, 3.5 m high unit, which we had to assembly inside the building and fit into the narrow space. This also meant that we needed to work amongst a lot of pipework." Gosselink and Groeneveld praised the Technical Facility Manager, who had arranged for cables to be moved and pipework to be made higher and adapted so that the booth had space to fit underneath. He also arranged for the space where the booth was to be fitted to be cleared and the floor area cleaned. "Efficient service for a research laboratory."

"For larger volumes we had various extraction hoods up until now."

Imposing

The result is impressive. The booth not only meets all the regulations, but also fulfils its promise of reducing noise and having excellent lighting. There are no unwanted draughts or noise. There are absolutely no draughts and no noise, that's quite impressive with an air exchange of 35,000 m³ per hour. According to Rüpp, Gosselink and Groeneveld everything ran smoothly. Connecting the electrics was the only area where the booth assembly team needed a while longer. Everything ran exactly according to plan. Project leaders Groeneveld and Gosselink knew right from the start what they wanted, but not how they could obtain it. Rüpp comments: "The preferences and requirements were very clear, but we lacked detail. This was a good thing. It gave us freedom when it came to implementation, so that we weren't limited by various complex prior requirements and we were able to trust our specialist knowledge. We appreciated this and thanks to the excellent communication and cooperation during the project, there were no problems." DENIOS has already been working with BASF for many years, and had earlier developed and supplied equipment for the catalyst factory, so was in a position to fully understand the requirements of the chemical company.

Starting small

Groeneveld: "The whole project started quite small. When you start working on the project you think that a small extraction booth would perhaps be quite practical when working with larger quantities of powder. Then you start talking to other people and looking at brochures, and before you know it the booth takes up half the hall. And now we have a safe, protected area where we can work," she says, while showing us the highly impressive booth with her colleagues and Sander Rüpp. The area looks bigger as there is no Speedmixer in at the minute. "Working is not safer, as before it was already safe, but it's definitely simpler. I'll say it again: We now have to do less to guarantee the same level of safety, so we can get to work quicker!"

Project management and service

- Project management and documentation
- Service from one supplier
- DENIOS Academy
- DENIOS worldwide

Professional project management: Advice – Solution – Service and Maintenance

A DENIOS containment technology solution is seldom standard, but is created in accordance with your specifications, requirements and preconditions. DENIOS' decades of experience in international markets means that we have a large network of specialists available to support you. From consulting to maintenance, our customers benefit from a made-to-measure service.

A visit in person establishes an individual needs analysis and we can then draft a needs-oriented application profile. Special circumstances can then be added directly into the plan. A firm quotation is then produced. Our engineers design and plan each customer's project as an individual assignment.

Working closely with the customer, the project is planned in accordance with applicable regulations. Then the ventilation equipment is manufactured by our certified technicians in our own production facilities. The status of the project can be seen at any time by the customer - everything is traceable and transparent.

The ventilation equipment is installed at the customer's site and commissioned. DENIOS technicians ensure installation is safe and professional and instruct the operator on how to operate the product directly. Comprehensive documentation is of course all part of a DENIOS solution.

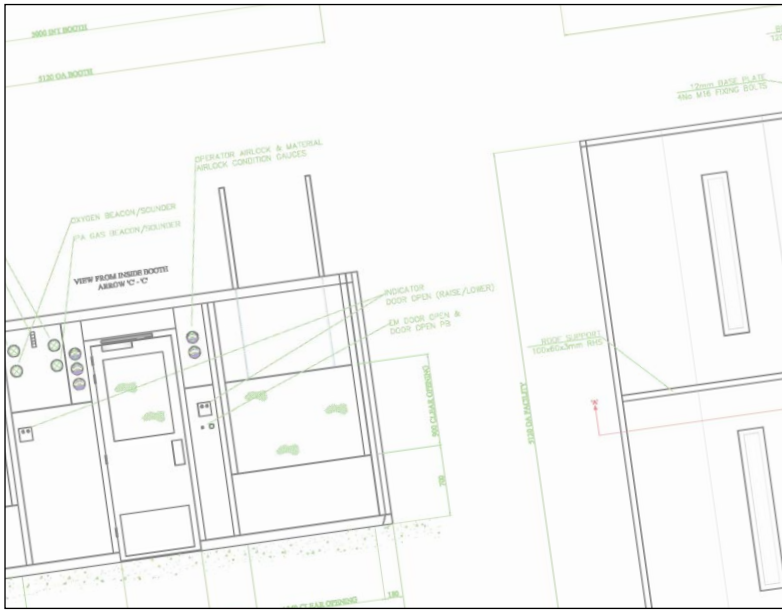
Our maintenance team includes certified technicians and specialists, who know each DENIOS project inside out. Our after sales team can add a customised maintenance bundle to any solution - we'll send a reminder for regular maintenance, we will carry out repairs on site and our customer's benefit from attractive discounts.

Project management and documentation

The customer receives a comprehensive pack of drawings and documents

FAT & SAT

When you use a product or system, DENIOS has already carried out comprehensive safety tests: During a Factory Acceptance Test (FAT) at the corresponding production site, your system will have been checked for conformity to all specifications. In addition, if requested, we will also carry out a Site Acceptance Test (SAT) after the equipment has been fully installed at your premises. The test results are then entered into a document covering the site acceptance test for the installed equipment. You can then add this document to your risk inventory and evaluation file. This document verifies that your safety system offers a corresponding level of protection for your employees. This duty of care is the most important basis for workplace health and safety laws as well as the corresponding directives at the European level.



Documentation

Qualifications Master Plan document
This report is used to determine the content and scope of the factory acceptance tests and site acceptance tests. It includes the acceptance requirements for installation and operation as well as the criteria for the additional fixtures and installation of the equipment at the customer's site.

Documentation
All documentation is supplied with a full documentation pack in accordance with the corresponding FDA regulations. A full document pack is available to view within 3 weeks of the order date.

Quality Plan document
The quality control processes are carried out in line with the activities specified in the plan and the data given and recorded in the equipment datasheet. Each activity is signed and initialled by the person responsible. The customer checks the data and confirms that each task has been completed as required - including the project schedule (milestones), quality assurance and quality control.

DQ Design Approval document
The design approval and associated documents confirm that the design meets the specifications agreed with the customer. This includes: the technical specifications, the design calculations, the fan performance diagrams, the motor datasheets, the technical specifications for the main components and the spare parts list.

IQ (Installation approval) reports and documents
Tests to confirm that the equipment has been installed in accordance with the approved specifications and drawings. Calibration of test instruments and equipment instruments. Material test certificates, test certificates for the electronics, declaration of conformity for the main components.

OQ (Operation approval) reports and documents
Function checklist; tests to ensure correct operation to confirm:
- Airflow speed, noise level
- Lighting level
- Airflow smoke profile
- Filter tests
- Airflow quality and particle measurements

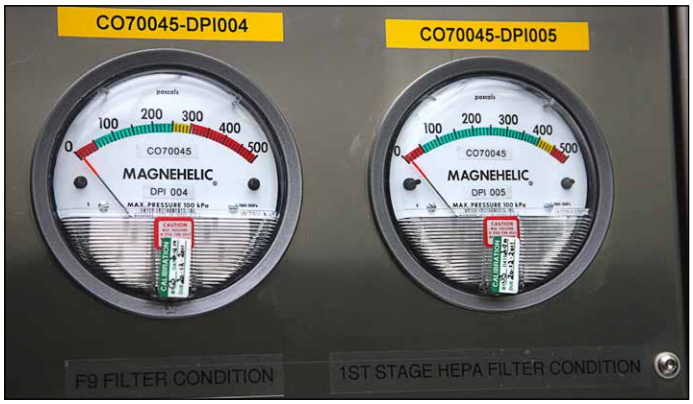
FAT (factory acceptance test) document
To confirm that the equipment meets the functional requirements as well as the corresponding quality standard.

SAT (site acceptance test) document
This report determines the installation inspections, the requirements for operational tests and acceptance criteria for the equipment.

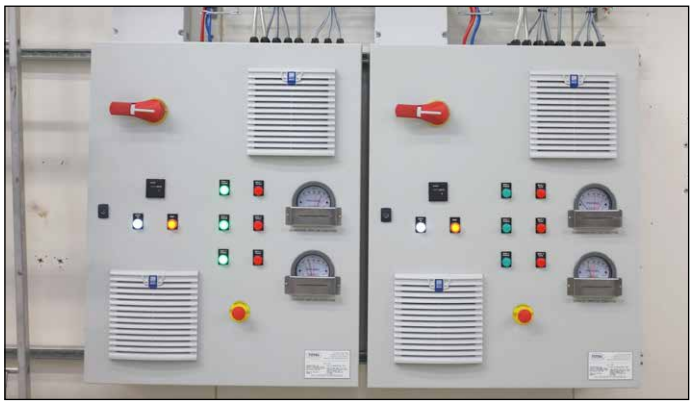
Certificates
- Original certificates, CE certification and test results

Operation and maintenance handbooks
- Operating instructions; maintenance plans, corrective maintenance, spare parts lists, user training, maintenance training

Drawings
- Complete drawing
- Piping and Instrumentation drawing – PID
- Operational flow diagram
- Circuit diagrams



Magnehelic differential pressure gauge, which confirms the status of the airflow and the filters, including marked safe operating areas

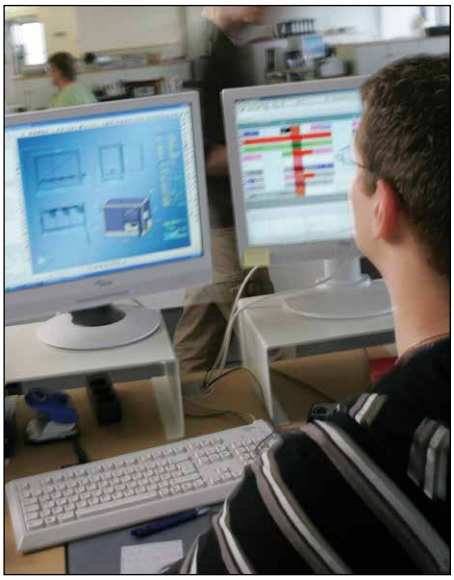


Individual control systems

Project management and documentation

Project management from one supplier

One contractual partner for the whole process ensures direct communication.



Model

System models for tests and checking ergonomics, so that the systems meet the requirements of our customers.

Manufacturing and prefabrication

Fabrication using the latest CNC technologies in our own state of the art production facilities.

Equipment is prefabricated and tested by us first of all. The customer is present at the tests. The equipment is then disassembled and packed ready for transport to site. The works acceptance test documentation is produced.

Installation

The installation takes place according to the agreed schedule and the safety and risk evaluation process description. An installation acceptance document is produced to ensure that the equipment meets the requirements of the design specification.

Complete safety for your area of application

Development, design, manufacture, installation and customer service

Complete testing services, FAT, SAT including IQ/OQ

- HEPA filter test
- Laminar downward airflow test
- Airflow quality (particle measurement) test
- Noise level measurement
- Light level measurement
- Airflow smoke test
- Gravimetric test
- Temperature control test
- Electrics test

Commissioning and training

The equipment is commissioned after installation acceptance as long as the tests confirm that the operating parameters are met by the correspondingly calibrated instruments.

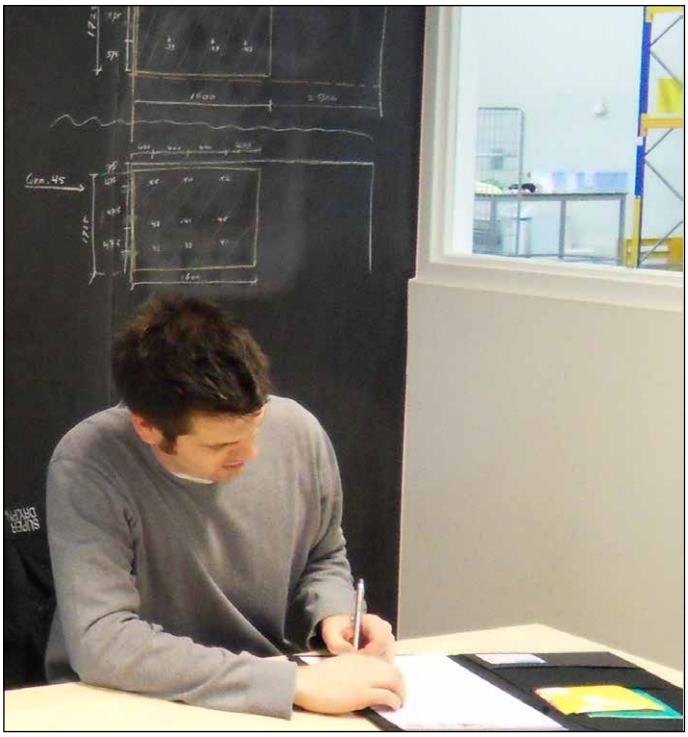
Operator and maintenance training takes place in accordance with the operator's instructions to guarantee that all equipment meets the agreed maximum workplace exposure limits.

Particle measurement

The airflow quality is tested by particle measurement as part of the acceptance test. This measurement is carried out and a report produced by a qualified, independent specialist company.

Customer Service

We offer customer service contracts, annual maintenance and inspections as well as 24 hour customer service.



Safety needs service – from one supplier

Maintenance services

- One-off inspection or maintenance contract
- Trained and certified service technicians
- Small repairs carried out directly on site, more involved repairs will be quoted for separately
- Production of a service report and test report
- Fitting of the inspection plate
- Travel costs and small consumables are always included in the maintenance price

Your advantages

- Legal requirements for maintenance intervals are observed
- Maintenance of your insurance protection including limitation of company liability in the event of a loss
- Save the expense of costly repairs with regular maintenance
- Minimise the risk of downtime and extend the life of your equipment
- Don't worry about tiresome scheduling. With a maintenance contract, we'll remind you in good time when maintenance is due
- Safety for your employees and your company

Service

Service - for DENIOS, this means our overall approach to your project, from the needs analysis to official acceptance.
We guarantee worldwide competent advice in accordance with the relevant local legislation.
We are also your reliable partner for maintenance. In your contract we will ensure that the maintenance and repair of your technical equipment meets the legal requirements at the required intervals.

Our maintenance programmes are as individual as our products, and custom made for your requirements. From one-off "on demand" maintenance to a cost saving, long-term maintenance contract, DENIOS offers made to measure solutions for everyone.

Request your free personal Service booklet from:
Tel.: 0800 / 753-000-4

It's all covered: Service from DENIOS

Every product taken care of

When our technicians come to your site, every important detail is taken into consideration. The process may vary, depending on the product to be inspected. We pay particular attention to:

- Inspection of general condition
- Visual inspection for damage and defects
- Inspection and replacement of the filter cells
- Functional inspection of mechanical parts
- Extraction volume and air speed test
- Production of test reports

Is the legally required air exchange rate still ensured? Do the fire protection flaps operate correctly? Are the sensors supplying the necessary data? Only when all the safety-relevant components have been extensively tested will we assign the proverbial tick.

DENIOS HazMat Manual

The DENIOS HazMat manual is an essential source of knowledge for hazardous materials storage. Over 60 pages cover the principal laws, regulations and information on the storage of hazardous materials and work safety. DENIOS customers are always kept well informed.

Membership pays!

Regular long term maintenance ensures your investment keeps working. When you sign up to a service contract you'll also benefit from an extension to the **DENIOS warranty to 5 years.***
Get your Carefree Card today and apply for your **DENIOS Premium Service Card.**

* Applies if a service contract is taken out within the first year after delivery.

Experts training-experts

DENIOS ACADEMY

Sharing our knowledge

Expert knowledge: in-house and on-site

Our seminar programme offers excellent training and education for subjects such as fire protection, work safety, hazardous substances and environmental regulations.

Ensure regular updates on theory and practice for these complex subjects for you and your employees. Seminars usually take place in the DENIOS Academy training rooms, but may also be held on your premises if required. A special highlight: DENIOS expertise on tour with our HazMat days.

Seminars are held at unusual locations across Germany.

In Switzerland we offer emergency leak training, gas talks and Experimental lectures. These are held at customer premises.

Showroom: Products to try out

There are over 10,000 products in the DENIOS catalogue and Online Shop. In our showroom in Bad Oeynhausen we've brought together our most popular products and bestsellers. Here you can get a real feel for our manufacturing quality, check out different functions or receive training in safe handling. A direct comparison of various product models can also be arranged. Our colleagues will be pleased to assist. Looking at interactions with other DENIOS products often leads to new ideas on how you could use them in your own company.

.... or do you need something really individual?

Are you on the hunt for a training course designed especially for your needs or a location for your next conference? Our meeting rooms don't just offer a professional setting. We would be happy to enhance your agenda with lectures, workshops, guided tours or seminar days. Speak to us - we'll be happy to help run your custom event!

! DENIOS Academy: All the information and dates are available online

www.denios.de/akademie

www.denios.at/akademie

www.denios.ch/akademie

DENIOS worldwide

DENIOS
ENVIRONMENTAL PROTECTION
& WORK SAFETY

DENIOS International

Belgium	www.denios.be	Italy	www.denios.it	Romania	www.denios.ro
China	www.denios.cn	Canada	www.denios.ca	Sweden	www.denios.se
Denmark	www.denios.dk	Mexico	www.denios.mx	Slovakia	www.denios.sk
France	www.denios.fr	Netherlands	www.denios.nl	Spain	www.denios.es
Finland	www.denios.fi	Norway	www.denios.no	Czech Republic	www.denios.cz
UK	www.denios.co.uk	Poland	www.denios.pl	USA	www.denios-us.com
Ireland	www.denios.ie	Portugal	www.denios.pt		