



Biosafety cabinets

# Efficiency, safety and value for routine applications

MSC-Advantage Biological Safety Cabinets

# Sample and user protection

## Containment, comfort and convenience

### 16.6

The Thermo Scientific™ MSC-Advantage™ Class II Biological Safety Cabinet combines safety, energy efficiency and value for today's laboratory. The cabinet is energy efficient and provides both, personal and product protection from biological hazards and contamination. It can be connected to an external exhaust to provide protection for trace amounts of volatile toxic chemicals that are sometimes used in the cabinet. The cabinet meets EN 12469 for Class II biosafety cabinets.



#### Containment

- Thermo Scientific™ SmartFlow™ technology automates airflow balancing and compensation
- Digital Airflow Verification (DAVe) alerts user to compromised product and operator protection
- H14 HEPA filters remove airborne contaminants
- SmartFlow™ indicator displays performance status



#### Comfort

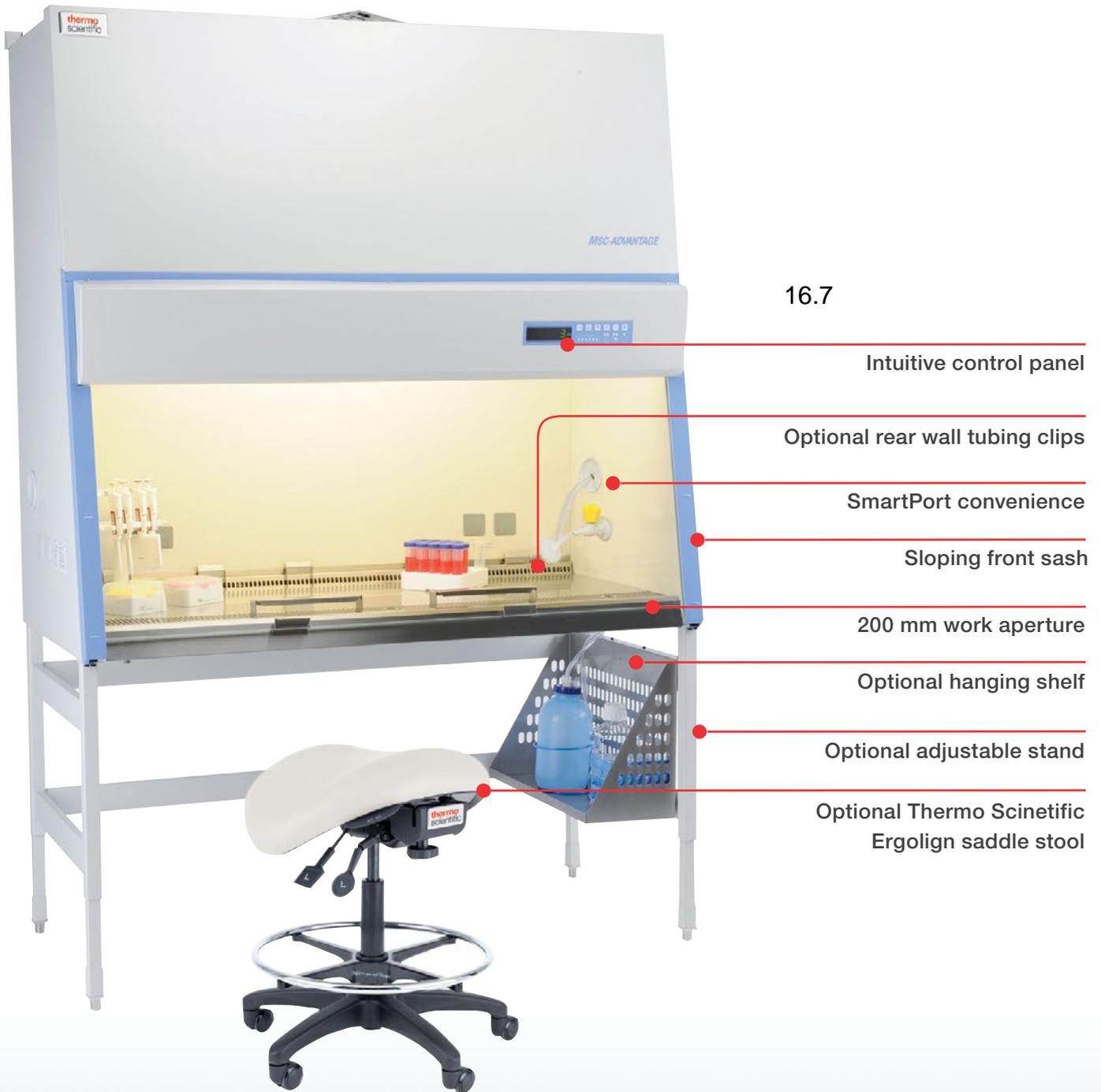
- Low noise level enhances user focus
- 10° sloped front for exceptional comfort and ergonomics
- Spacious work area with comfortable armrests
- Increased light intensity for a brighter work environment



#### Convenience

- SmartClean front window design to improve cleaning and loading of large equipment
- Intuitive control panel displays safety and performance data
- Thermo Scientific™ SmartPort™ design organises tubing and cables
- Programmable UV light extends bulb life and saves energy

# Basic controls and convenient features



## Efficiency 16.5

- DC motors offer low energy consumption
- Standby mode reduces airflow to 30% during low-usage periods
- Long filter life\*
- Programmable UV light extends bulb life\*

\*Compared to previous models.

## Specifications

Size/internal width	0.9m	1.2m	1.5m	1.8m
Exterior dimensions WxHxD (mm)	1000 x 1522 x 798	1300 x 1522 x 798	1600 x 1522 x 798	1900 x 1522 x 798
Interior dimensions WxHxD (mm)	900 x 780 x 630	1200 x 780 x 630	1500 x 780 x 630	1800 x 780 x 630
Shipping dimensions WxHxD (mm)	1110 x 1730 x 925	1410 x 1730 x 925	1710 x 1730 x 925	2010 x 1730 x 925
Net weight (Kg)	170	200	230	280
Shipping weight (Kg)	190	225	265	315
Working opening height of front window	200 mm			
Maximum opening height of front window	535 mm			
Max load capacity per work surface segment	25 kg			
Certification to EN12469	TÜV, LNE	TÜV, LNE	TÜV	TÜV
16.2 Light power (Lx)	>800	>850	>1250	>1300
Receptacles	2 sockets, right rear wall		4 sockets: 2 on each side rear wall	
16.5 Noise level (dBA)	<55	<55	<59	<59
Energy consumption, operating set point (W)	150	200	280	340
Energy consumption, reduced flow mode (W)	40	40	70	70
Normal heat output in operation (BTU/hr)	512	682	955	1160
Normal heat output in reduced flow mode (BTU/hr)	136	136	239	239
Exhaust/inflow air volume (m3/h)	292	389	486	583
Ducting requirements, thimble connection (m3/h)	379	505	632	758



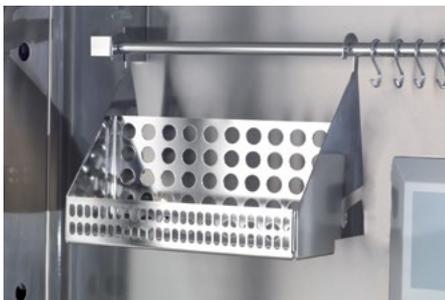
**Manually adjustable stand** enables cabinet to be set at a comfortable working position between 750-950mm



**Configurable work surface** improves flexibility of the working area



**Side wall service taps** are easy to install



**Utility basket** with hanging bar increases flexibility of the working area and helps improve organisation



**SmartPort floor stand hanging shelf** to keep area beneath cabinet clear to ensure adequate legroom for a comfortable working position



**Direct duct exhaust** can be added when working with trace amounts of volatile chemicals

## Ordering information and accessories

Description	Cat. no.			
	0.9m	1.2m	1.5m	1.8m
MSC-Advantage Class II Biological Safety Cabinet, 230V, 50/60Hz, EN12469	51028225	51025411	51028226	51025413
Fixed floor stand (height of 680mm)	50116441	50109309	50116442	50109311
Castor set - fixed stands only	50109977			
Manual adjustable floor stand (height of 680-880mm)	50116443	50109312	50116444	50109313
Electronic floor stand (height of 680-880mm)	50117449	50109314	50117450	50109325
Foot rest bars (Not for electric stands)	50051982	50051983	50051984	50051985
Removal of 316 SS work surface	51901025	51900915	51901027	51900916
316 SS worksurface (single piece)	50076398	50082970	50122210	50085281
316 SS worksurface (single piece - lowered)	50073669	50073670	50073671	50078750
Replacement ergonomic arm rests (316 SS and gel inserts)	50156438			
Additional exhaust HEPA filter	50109987			50109988
Additional carbon-enhanced filter	50109989			50110305
Factory-installed UV light option	51900912			
Vacuum tap G3/8 connection (grey) with long neck	50044678			
Water tap G3/8 connection (black) with long neck	50044679			
Non-combustible G3/8 connection (green) with long neck	50045959			
Combustible G3/8 connection (yellow) with long neck	50046015			
Solenoid valve for combustible G3/8 (yellow) connection	50109978			
Lead through for hose connections 10-13mm inner diameter hose	50059017			
Lead through for hose connections 3mm inner diameter hose	50076408			
Thimble duct (KTD)	50109984			50109985
Direct duct (KDD)	50109981			50109982
Hanging bar with hooks	50125639	50109979		
Utility basket for hanging bar kit (hanging bar to be ordered separately)	50078900			
Ergolign cleanroom saddle stool	ERG-CR-2330			
Floor stand hanging shelf	50128685			
Replacement SmartPort grommets	50128681			
Rearwall clips for tubing	50128703			
Switzerland country configuration	51900300			
UK country configuration	51900303			
Italy country configuration	51900306			
France/ Belgium country configuration	51900448			
Denmark country configuration	51900481			
Bulgaria, Czech Republic, Slovakia, Poland country configuration	51900771			
China country configuration	51900900			



 Learn more at [thermofisher.com/msc-advantage](https://thermofisher.com/msc-advantage)

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## **Operating Instructions Biological Safety Cabinet MSC-Advantage™**

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**1****General notes****1.1 Data of the MSC-Advantage and the documentation****Device identification**

Device Name:	Biological Safety Cabinet
Model:	MSC-Advantage™
Model lines:	0.9, 1.2, 1.5, 1.8
Model 1.2.from serial devices:	41070608
Model 1.8.from serial devices:	41070639

**Assignment of the product documentation**

User manual:	501268856
Availability:	04.2011

**Certification and Quality Audit:**

Conformity:	CE conformity marking
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**1.2 Instruction of the operating personnel**

These operating instructions describe the biological safety cabinet

- MSC Advantage

and apply to the models MSC 0.9, 1.2, 1.5, 1.8.

The biological safety cabinet has been manufactured in keeping with the latest technological developments and has been tested before delivery for its correct function. It may, however, present potential hazards if it is not used according to the intended purpose or outside of operating parameters. Therefore, the following procedures must always be observed to prevent accidents:

- The biological safety cabinet must be operated only by trained and authorized personnel.
- For any operation of this device, the operator must prepare clear and concise written instructions in the language of the operating and cleaning personnel based on these operating instructions, applicable safety data sheets, plant hygiene guidelines, and technical regulations, in particular:
  - which decontamination measures are to be applied for the cabinet and accessories,
  - which protective measures apply while specific agents are used,
  - which measures are to be taken in the case of an accident.
- Repairs to the device must be carried out only by trained and authorized expert personnel.

**1.3 Applicability of the instructions**

- The contents of the operating instructions are subject to change without further notice.
- Concerning translations into foreign languages, the German version of these operating instructions is binding.
- Keep these operating instructions close to the device so that safety instructions and important information are always accessible.
- Should you encounter problems that are not detailed adequately in these operating instructions, please contact Thermo Fisher Scientific immediately for your own safety.

**1****General notes****1.4 Warranty**

Thermo Fisher Scientific warrants the operational safety and functions of the biological safety cabinet only under the condition that:

- the device is operated and serviced exclusively in accordance with its intended purpose and as described in these operating instructions,
- the device is not modified,
- only original spare parts and accessories that have been approved by Thermo Fisher Scientific are used,
- inspections and maintenance are performed at the specified intervals,
- an installation test is performed prior to the initial operation of the device and that a repeat test is performed on the occasion of all inspections and repairs.

The warranty is valid from the date of delivery of the device to the operator.

**1.5 Standards and safety regulations**

The device complies with the safety requirements of the following standards and directives:

- EN 12469
- NF 095 Rev3.2006 / NF - Postes de Sécurité Microbiologique
- IEC 61010-1
- EN 61010-1
- EN 12469
- DIN EN 61326-1
- Low Voltage Directive 2006/95 EG
- EMC Directive 2004/108 EG

For the setting-up and installation of the biological safety cabinet the respective national regulations must be observed.

**1**

**General notes**

**1.6 Explanation of symbols**

**1.6.1 Symbols used in the operating instructions**



**WARNING!**

is used if non-observance may cause serious or even lethal injuries.



**CAUTION!**

is used if non-observance may cause medium to minor injuries or damage.



**NOTE!**

is used for hints and useful information.



**RECYCLING!**

Valuable raw materials can be reused.



Warning against electric shock.

**1**

**General notes**

**1.6.2 Symbols on the device**



**Observe operating instructions (switchbox ceiling)**



**Warning against hand injuries (device side walls)**



**Biohazard (left front section of device)**



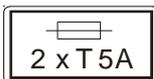
**CE Conformity declaration**



**Checked safety (cover light dome)**



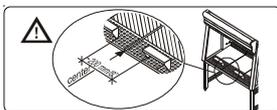
**Norme Française / NF - Postes de Sécurité Microbiologique**



**T5A note (sample chamber fusing)**



**RS 232 interface (top side of plenum panel)**



**Installation of the armrests (right side of the light hood)**

**1****General notes****1.7 Use of the device****1.7.1 Correct use**

The Biological Safety Cabinet is a laboratory device for installation and operation in microbiological and biotechnical laboratories of safety levels 1, 2, and 3. It has been designed as a Class II microbiological biological safety cabinet, in accordance with EN 12469.

Depending on the hazard level of the agents involved, the operator must prepare in writing appropriate decontamination procedures for the device and the accessories used in the sample chamber.

Prior to the initial operation of the cabinet, the operator must perform an installation test. The test result must be documented by a test report. The cabinet must only be released for operation if it is in compliance with the operating parameters specified by Thermo Fisher Scientific.

After any changes to the installation conditions and after any modification to the technical system, a repeat test must be performed and the test result must be documented by a test report that shows that all operating parameters are in compliance with those specified by Thermo Fisher Scientific.

**1.7.2 Incorrect use**

The biological safety cabinet must not be used in laboratories that do not comply with the requirements of safety levels 1, 2 or 3.

The device must not be operated as a Class II biological safety cabinet if:

- no repeat test is performed after changes to the installation conditions or after modifications to the technical system,
- the alarm system of the device has issued a failure message and the cause for the failure has not been repaired.

The alarm system must not be tampered with or disabled. If alarm system components have been removed or disabled for service or repairs, the device must only be released for operation if all alarm system components are functioning properly again.

The filters installed in the device are not capable of separating gaseous substances. Therefore, never store or process gases or gas-releasing substances in the device:

- which in quantity or concentration are toxic,
- if a reaction with other substances may result in hazardous toxic concentrations or formation of toxic gases,
- that may form combustible or explosive mixtures in combination with air.

**2****Delivery****2.1 Scope of delivery**

Delivery for the biological safety cabinet includes the following:

- biological safety cabinet (without stand)
- armrests
- device documentation:
  - operating instructions
  - factory test report

Optional components and accessories are listed as separate items in the delivery document.

**2.2 Acceptance inspection**

After the device has been delivered, immediately check the device:

- for completeness,
- for possible damage.

**If the delivery is incomplete or if you detect any transport damage to the device, contact the forwarding agency and Thermo Fisher Scientific immediately.**

**2.3 Transport security lock and device packaging**

A transport security lock protects the device counterweight during transport. Protective packagings protect the floorpan, the front window, and the workplate segments. To remove the transport security lock and the protective packagings, please refer to the enclosed installation instructions and to Sections 5.2 and 5.3 of these instructions.

**3 Installation**

**3.1 Ambient conditions**

The operational safety and correct function of the device depends on the location where it is to be operated. The biological safety cabinet must be operated only at locations that meet the ambient conditions listed below.

**Location requirements:**

- The electrical system of the device has been designed for an operating height of up to 2000 m above sea level.
- The mains power supply outlet should be out of casual reach to prevent accidental shut-off. Ideally, the outlet should be installed above the safety cabinet.  
The outlet must be accessible to authorized personnel only. It constitutes, together with the power cable plug, the disconnection device for all poles.
- The flooring of the location must be adequately strong and not flammable.
- The stand must ensure a sufficient load-bearing capacity (twice the device weight).
- The room in which the device is installed must be of adequate height. For devices that are not connected to an exhaust system, the distance between the exhaust air opening at the device ceiling and the room ceiling must be at least 200 mm (8 in).
- The location must be equipped with an appropriate ventilation system (see Section 3.2.).
- For the valves may be installed a lateral distance of at least 300 mm is required to ensure accessibility for the installation, see Chapter 4.6
- The temperature within the room must be between 15 °C and 40 °C (49 °F and 104 °F).
- The relative humidity in the vicinity of the device must not exceed 90 %.

 **NOTE - Ambient conditions!**

**If ambient conditions vary from those described above, please contact Thermo Fisher Scientific for assistance in installing the device.**

 **NOTE - Temporary storage!**

**If the device is stored only temporarily (up to four weeks), the ambient temperature may be between -20 °C and +60 °C (-4 °F and +140 °F) at a relative air humidity of up to 90 %. For longer storage periods, the location requirements apply.**

**3**

**Installation**

**3.2 Room ventilation**

The room ventilation should preferably be a ventilation system that complies with the national requirements for the application.

- The inlet air and exhaust air openings of the room ventilation must be located so that drafts are prevented from impairing the function of the safety cabinet air system.

**Coupling to laboratory exhaust systems**

Coupling biological safety cabinets to a laboratory exhaust system, air that spills of biological agents must be discharged to prevent inflow to the installation space. The ventilation system of the biological safety cabinet itself are not to be influenced. If a coupling to a laboratory exhaust system is installed, it must be ensured that no harmful air flow is created in the installation space. The volume of air discharged by the exhaust system must be tracked accordingly into the installation space. It should be noted, that the equipment air flow itself is not affected.

The on site exhaust system should be dimensioned, so the air velocity scale in the draft interruptor and exhaust air plenum is sufficient, that the equipment exhaust air has no air resistance.

In states, where the coupling to a laboratory exhaust system is regulated by further provisions, the relevant national regulations must be observed.



**CAUTION – Installation test!**

**During the initial start-up of the biological safety cabinet an initial installation test must be performed.**

**The installation location of the biological safety cabinet with connection to a technical ventilation or with a coupling to laboratory exhaust system and additional installed exhaust accessories are not to be changed.**

**Every modification of the installation location requires a new installation test (see chapter 5.6)!**

**3 Installation**

**3.3 Correct location**

Choose a draft-free location where the biological safety cabinet does not interfere with the plant traffic.

**Fig. 1:** This figure shows preferred locations for biological safety cabinets and unsuitable locations that are not in accordance with the safety requirements.

**Unsuitable locations:** The locations [1], [2], and [3] are not suitable because they are exposed to drafts from windows and doors.

Location [5] is unsuitable because it is within range of plant traffic and within the exhaust air range of a ventilation system [4].

**Preferred locations:** The locations [6], [7], and [8] are correct because they are in a draft-free section of the room and not exposed to plant traffic.

A counterweight at the device backpanel moves synchronously with the vertical movement of the front window. To prevent the counterweight from jamming, the device backpanel should be as close to the wall as possible.

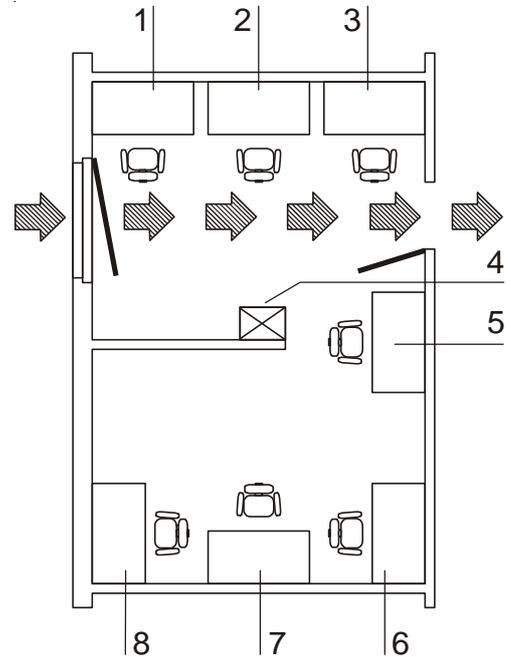


Fig. 1  
Device arrangement in the operating room

**3.4 Installation in series**

When several devices are to be installed in series, please observe the following:

- Make sure that vibrations cannot be transferred between adjacent devices.
- Exterior surfaces of the cabinets must always be accessible for cleaning and disinfection.

### 3.5 Transport

**Fig. 2:** To prevent tilting, always transport the device using a suitable carrier, even for a transport within a building, and separate it from the stand (see Section 5.2).



**CAUTION – Tilting danger!**

If the unit is tilted too much during lifting, risk of tipping exists. Lift the biological safety cabinet only vertically!

For transportation (including inside buildings) use an appropriate lifting device, which ensures that the unit:

- is on a stable stand and
- is secured against lateral tilting.

Do not transport the biological safety cabinet on a base with roles.



**CAUTION – Lift points!**

For transport, lift the device only at the lift points shown in Figure 2.

Do not allow the weight of the cabinet to rest on the floorpan!



**CAUTION – Crushing hazard!**

The weight of the front window is counterbalanced by the counterweight (at the rear of the device).

The device must not be transported unless the counterweight has been locked.

- Install the four lockscrews (see Section 5.3).

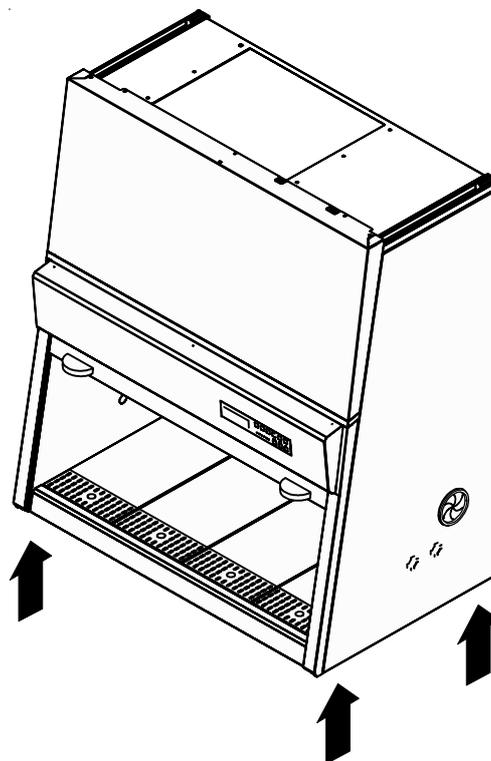


Fig. 2  
Lift points

**4****Description of the device****4.1 Overall view**

- **Fig. 3:** Plenum assembly [3] with plenum for downflow blower [19] and plenum for exhaust air blower [20]. The downflow filter and the exhaust air filter are installed immediately to the pertaining plenum. The exhaust air is discharged to the exterior of the device through an opening.  
The plenum assembly is concealed behind a cover [18].
- Switchbox [2] with power supply unit and power supply cable [1]. The top of the device contains an RS 232 connection [23] for a PC and two fuse holders [22].
- Light dome [4] for the sample chamber illumination unit, equipped with one fluorescent tube (model MSC 1.2) or two fluorescent tubes (model MSC 0.9, 1.5, 1.8).  
The optional, device-integral UV lamp is installed to the ceiling at the front section of the sample chamber.
- Operating panel [5] with function keys and indicators.
- Front window [7] with two handles [6].
- Bushings [8] and [9] in the side panels (3 on each side). The bushings [9] can be used to install media valves [11], the bushings [8] of type SmartPort are provided for laying cables or hoses into the utility chamber.
- Stand [10] (optional).
- Workplate segments [13] with 2 armrests [14]. A one-piece workplate and special workplates are available as optional accessories.
- Internal outlets [15] for the power supply of accessories (optionally, one of the outlets can be equipped with an adapter [17] for mobile UV devices).
- Test hoses for the downflow unit [16] at the left side of the sample chamber and for the exhaust air unit [12] at the right side of the sample chamber.

**NOTE – Test hoses!**

**Do not remove the caps of the two test hoses for checking downflow and exhaust air.**

**4** Description of the device

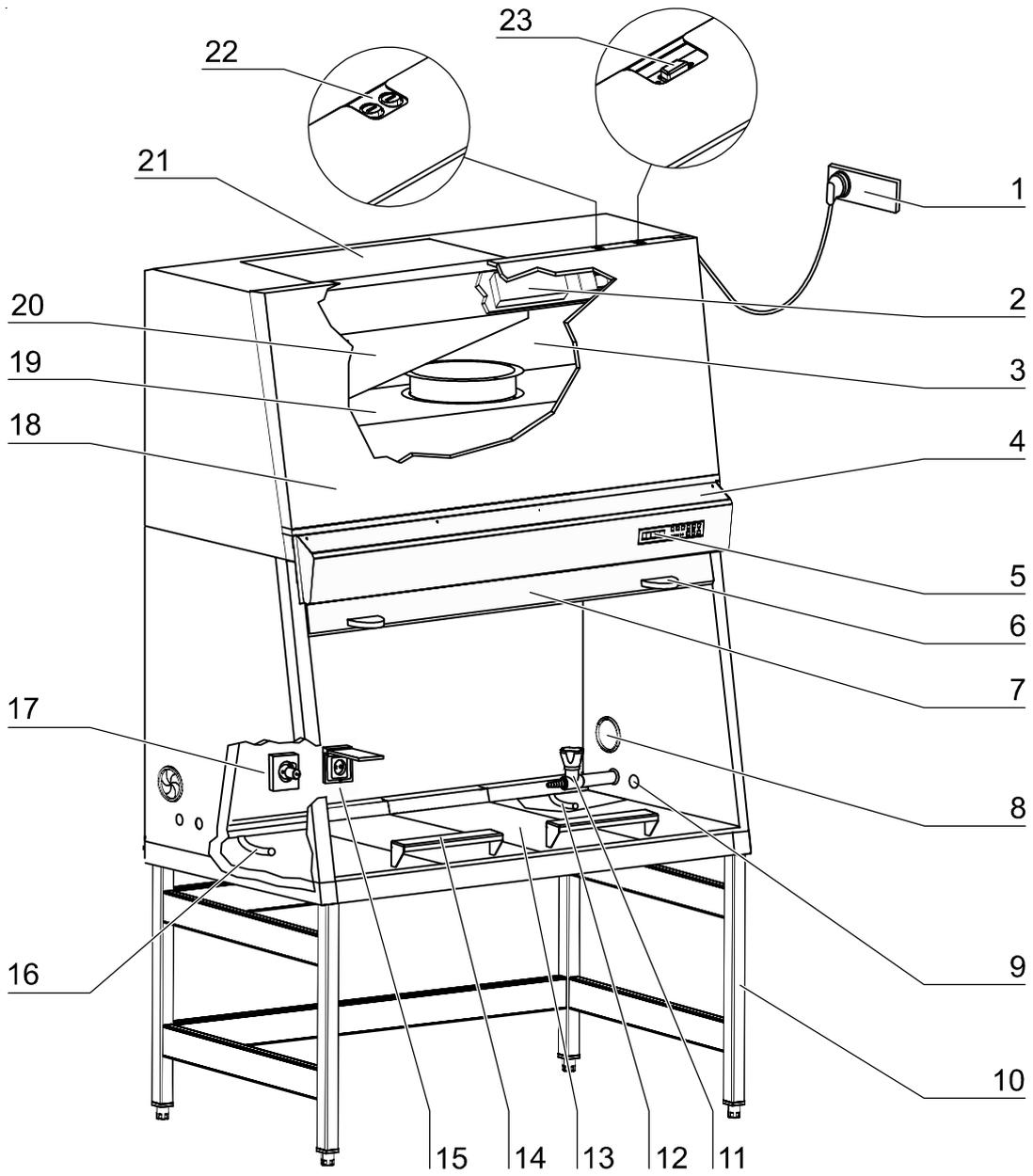


Fig. 3  
Overall view

**4 Description of the device**

**4.2 Safety system**

The safety system comprises a combination of protective and alarm systems that ensure maximum personal and material protection.

**Safety systems:**

- **Vacuum-sealed air system**  
A vacuum-sealed air system in combination with HEPA filters for downflow and exhaust air forms the basis of the safety system for personal and material protection. 16.4
- **Personal protection**  
Air aspirated from the exterior along the entire working opening at a constant high velocity prevents:
  - agents leaking through the working opening of the chamber.
 As the exterior air pressure around the device exceeds the pressure of the internal air system (vacuum sealing), it ensures:
  - agents cannot be released to the exterior in the case of a leak in the cabinet housing.
- **Material protection**  
A steady airflow within the air system ensures:
  - a constant downflow allowing the HEPA filters to remove contaminants so that the samples are always surrounded by ultrapure air,
  - harmful particles are not carried over through the sample chamber (protection from cross-contamination).
- **HEPA filters**  
The downflow (i.e. the air circulating within the device) and the exhaust air (air that is released to the exterior) are cleaned by HEPA filters (HEPA = High Efficiency Particulate Air Filter).
- **Safety lockout**  
To protect from UV radiation, the optional UV disinfection routine can be run only if the front opening is closed. During UV disinfection, the front opening safety lockout is activated and prevents harmful UV radiation from being emitted from the sample chamber.  
Circuits can be driven via potential-free contacts (monitor contacts), e.g. a solenoid that switches automatically upon cancellation of the work mode.

**Warning system:**

- **Airflow monitoring**  
Airflow monitoring determines the velocity of the airflow in the sample chamber as well as the inflow velocity of the air aspirated from the exterior through the working opening. As soon as airflow velocities move above or below a specified safety value, a signal is transmitted to the alarm system.
- **Visual and audible alarm system**  
The warning system constantly monitors the safety-relevant device functions:
  - Inflow velocity of the air aspirated from the exterior,
  - downflow velocity,
  - work position of the front window.
 If the warning system detects changes to one of these device functions, it issues:
  - an audible and a visual alarm signal.

4

Description of the device

- **Position monitoring**  
The position sensors detect the opening state of the front window and indicate whether the window is open or closed in the work position.
- **SmartFlow Indicator display**  
The SmartFlow Indicator displays the compensation capability of the exhaust control, if the window is in working position and blower on.

4.3 Filter system

**Fig. 4:** The filter system consists of two HEPA filters [5] and [2] for the device downflow and exhaust air.

**HEPA filters:** Room air [10] is drawn into the sample chamber through the working opening. In the air duct, room air and the downflow within the chamber [7] are then blended to make up the blend air [8]. The blend air is then:

- filtered proportionally by the downflow filter [5] and supplied as ultrapure air [6] evenly into the sample chamber of the device,
- filtered by the exhaust air filter [2] and released as ultrapure air [1] to the exterior of the device.

**Inlet air protection:** Multi-segment protective grids [9] are installed below the work surface in the air duct between sample chamber and device plenum. The grids prevent coarse particles from entering the plenum where they might impair the function of the blowers [3] [4] and of the filters [2] [5]. The grids can be removed for cleaning.

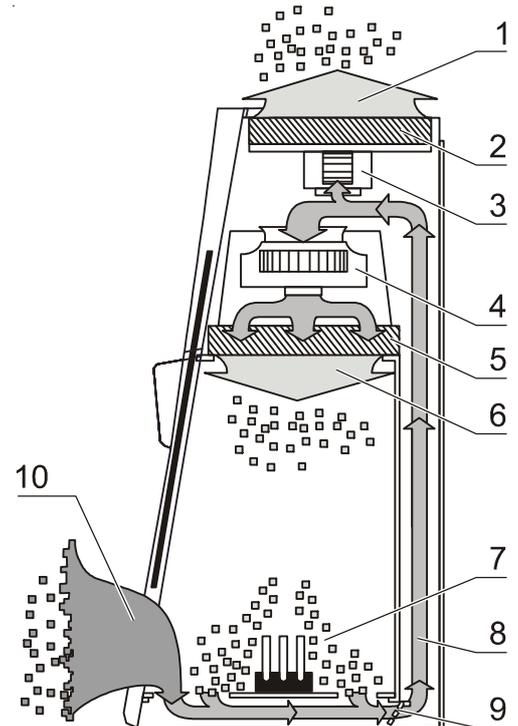


Fig. 4  
Filter system with downflow  
and exhaust air filter

**4 Description of the device**

**4.4 Operating and display elements**

**Fig. 5:** The biological safety cabinet is operated using an operating panel consisting of keys, function indicators and a display.

[A] The display with its 5-digit indicator panel shows the following information, regardless of the activated operating function:

- normal operation: operating hours of the device,
- safe work mode: downflow and exhaust air velocities,
- calibration routine: status of the calibration function,
- device-controlled UV disinfection (optional): remaining disinfection time.

Values are output as integers.

[B] Keys for switching operational functions on or off,

[C] Status indicators show the operational status of:

- front window work position,
- airflow,
- reduced blower speed,
- SmartFlow Indicator

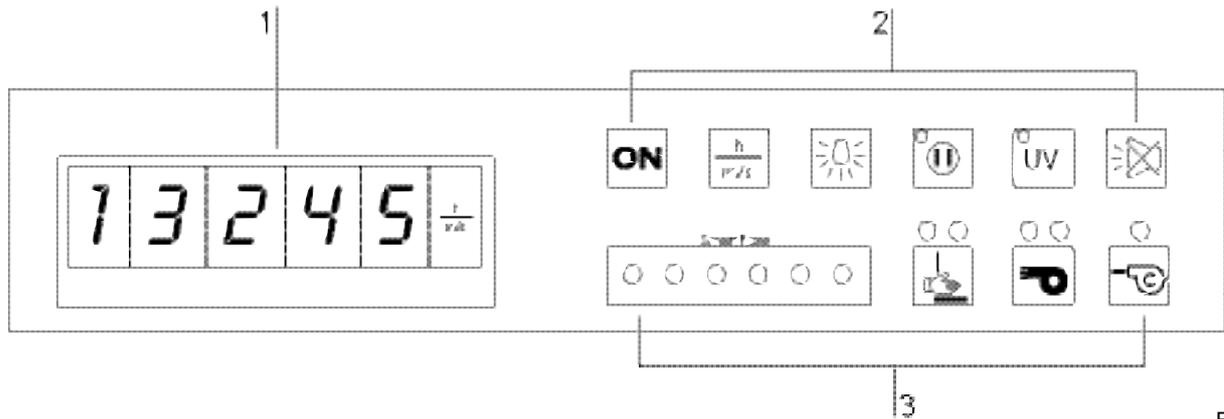


Fig. 5  
Operating and display  
elements

**4 Description of the device**

**4.5 Sample chamber access**

**Fig. 6:** The manually movable front window [1] made of multi-layer security glass seals the safety sample chamber front side up. The sample chamber is accessible through various positions of the front window.

**For operation:**

- Work position with opening height **A** for access to the sample chamber during the work process,
- maximal opening height **B** for loading the sample chamber,
- position **C** (closed state): closed front window and reduced blower speed.



**NOTE – Status indicator!**

**The two positions A and C are determined by switches and output as status indicators on the display (see Section 6.1.1).**

**For cleaning / maintenance:**

- SmartClean window cleaning position with opening height **D** for cleaning and disinfecting the upper section of the front window. For this purpose, the front window can be lowered beyond closed position **C** so that a sufficiently high gap exists between the sample chamber ceiling and the front window upper edge. This gap can be also used for replacing the sample chamber illumination lamps.



**CAUTION – Front window jamming!**

**Do not use force to move the front window. If the window is jammed or sluggish, contact Technical Service immediately. Do not attempt to repair this problem!**

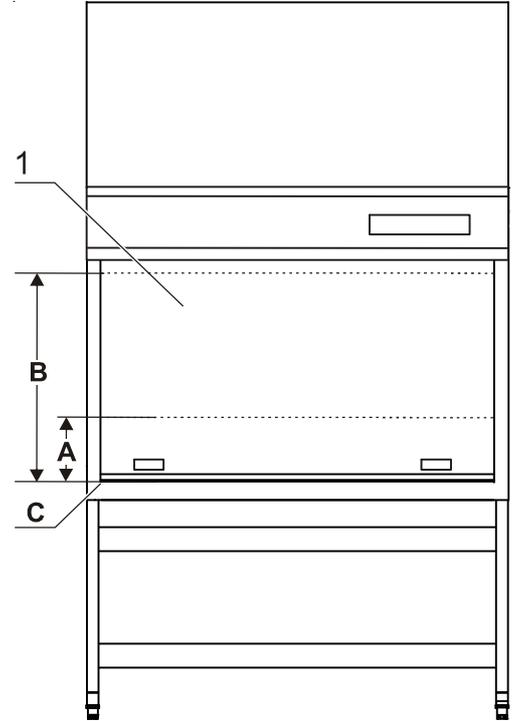


Fig. 6  
Sample chamber opening

**4 Description of the device**

**4.6 Device interfaces**

**Fig. 7:** The standard equipment includes:

- outlets for internal/external power supply,
- bushings on both sides for cables, media valves, and hoses,
- a communication port,
- a connection to external alarm systems.

**Power supply connection:** The connection to the power supply system is established via a cable with grounding plug [4] at the upper side of the device.

**Device-integral power supply:** The backpanel contains outlets [10] for the power supply (overall maximal current: 5 A) of internal accessories.

- 2 outlets (model MSC 0.9, 1.2)
- 4 outlets (model MSC 1.5, 1.8)

Optionally, an outlet can be replaced with a disinfection adapter [9] for the connection of a mobile UV device.

Two fuse holders for 5 A miniature fuses at the top of the front cover protect the device-integral power supply: [1] for (L), [2] for (N).

**Communication port:** The top of the device side contains an RS232 connection [3] for a PC.

**Bushings:** The standard fittings are 3 bushings per side panel.

SmartPort [6] is provided to lead through cables or hoses for accessories required in the utility chamber. To this end, the rubber grommet [5] is punched out in the exact opening size to avoid possible contamination.

Media valves [8] are installed solely in the bushings [7].

Media valves suitable for installing in bushings can be supplied as an option. Upon delivery of the device, the bushings are sealed.

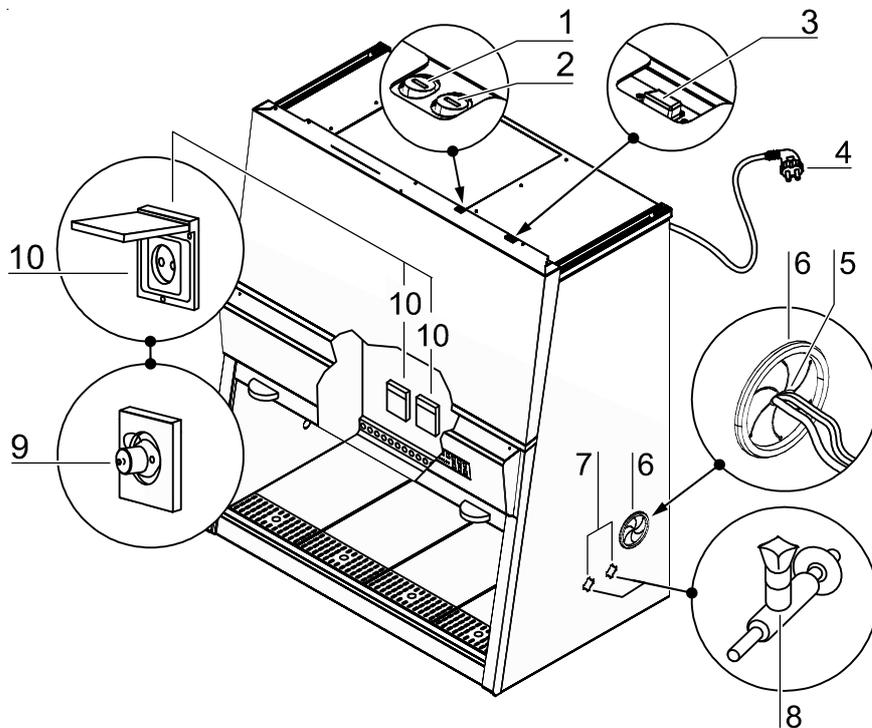


Fig. 7  
Supply interfaces

4

Description of the device



**CAUTION – Unstable underpressure!**

**Do not switch the unit off as long as cables/hoses are laid through the bushings. If breached bushings are not used in operation, new covers must be inserted in the openings to ensure stable underpressure in the utility chamber (see Chap. 10.4).**



**CAUTION – Combustible gas!**

**If a gas burner is to be operated in the sample chamber, an appropriate shut-off device for the gas supply system (shut-off valve, solenoid valve) must be installed.**

**To ensure a safe distance to the recirculation filter the laboratory safety burner are to be placed at the working surface and not at an elevated position.**

**Use only laboratory safety burners in the sample chamber.**

**Potential equalization:** To avoid static charges and the associated risks, if necessary, intended supply connections and the device itself should be integrated in the on-site potential equalization.

For this purpose, the potential equalization connection on the stand can be used. The installation of utility connections to the built-in fittings must be made with consideration to the current national technical rules.

**External alarm systems:** This alarm contact can be used for two different external alarm systems:

- Potential-free contact (valve) for driving external exhaust air systems (technical ventilation),
- Potential-free contact (monitor alarm) for the connection to an external alarm system (failure reporting system) or gas supply solenoids.



**CAUTION – High voltage!**

**The contact with live parts may result to a lethal electrical shock. During work on electrical equipment shut of the device and all poles disconnected.**

**Repairs to the device must be carried out only by trained and authorized expert personnel.**

**4 Description of the device**

**4.7 Sample chamber illumination**

**Fig. 8:** The sample chamber illumination unit [2]:

- one fluorescent tube for model MSC 1.2,
- two fluorescent tubes for model MSC 0.9, 1.5, 1.8,

is installed behind the light dome [3].

**4.8 UV lamp unit**

**Fig. 8:** The optional, device-integral UV lamp [1] is installed to the ceiling at the front section of the sample chamber. The operating time of the UV lamp is preset. The UV disinfection routine can be started by depressing a key on the operating panel.

 **NOTE – Protection from UV radiation!**

To protect from UV radiation, the UV lamp can be activated only when the front window is completely closed. When the front window is opened, the UV disinfection routine is cancelled immediately.

**4.9 Working area**

The standard equipment comprises the segmented workplate. The workplate segments are placed onto the frame above the sample chamber floorpan.

 **NOTE – Workplate condition**

Use properly plane lying workplates only. Replace deformed workplates. Pay attention to the maximum work load (see section 12)!.

**Fig. 9:** The working area **A** for optimal product protection extends over the entire width **B** and depth **C** of the workplate [1]. The two armrests [3] are positioned centrally to the working area at distance **D** (20 cm) from each other. For attachment, each armrest is inserted into the first perforation track [2] of the workplate.

 **NOTE – Using the armrests**

Safe working in the work mode of the device (see section 6.3) is ensured only if the armrests are used correctly!

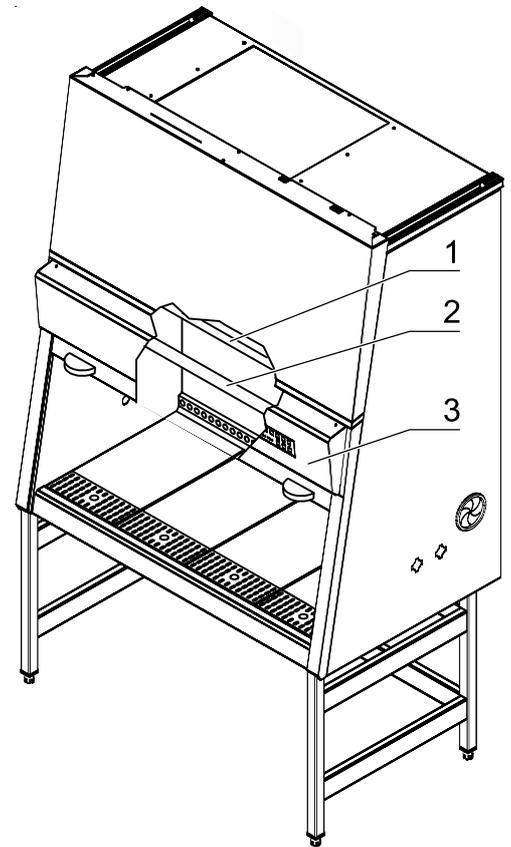


Fig.8  
UV lamp unit

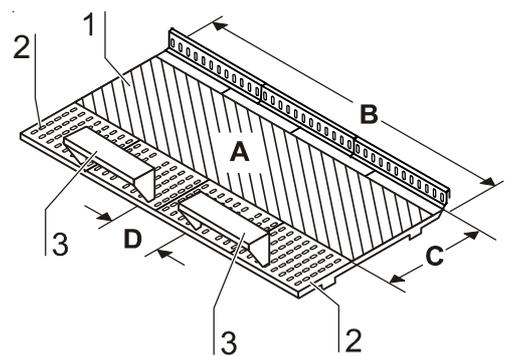


Fig.9  
Working area on the workplate,  
armrests

**5**

**Start-up**

**5.1 Initial operation**

Prior to the initial operation, the biological safety cabinet must be subjected to an installation test. Correct assembly and installation performed by the operator are essential for good start-up.

Upon the initial connection to the power supply system, the device control starts an automatic calibration routine to determine the parameters for the safety system of the device.

 **NOTE – Calibration routine!**

**The calibration routine is no substitute for the installation check performed by the service personnel.**

**5.2 Installing the device and accessories**

Device without stand:

- Place the device without stand onto a sufficiently stable substructure so that the weight of the device frame does not rest upon the floorpan.
- Remove the protective foil from the floorpan.

Device with stand:

Assemble the stand (accessory) and install the device frame onto the stand:

1. **Fig. 10:** Slide the two crossmembers [2] onto the retaining angles [3] of the side panels [1], then secure the crossmembers to the side panels using the screws with wedge lock washers [4].
2. To install the device frame [5] to the stand [7], insert four Allen screws with wedge lock washers [6] loosely into the threaded holes at the bottom of the device.
3. Place the biological safety cabinet onto the stand so that the Allen screws with wedge lock washers [6] are routed through the holes [8] of the retaining tabs [10].
4. Slide the device frame [5] into the retaining tab grooves [9] all the way to the stop.
5. Tighten the four Allen screws with wedge lock washers [6].

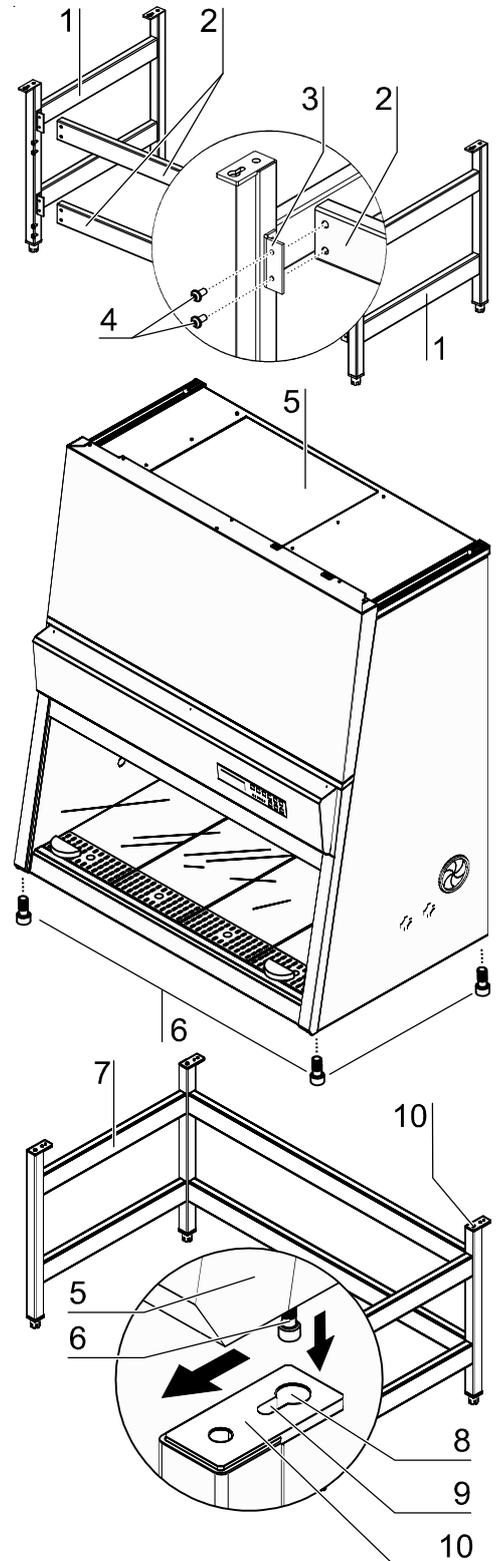


Fig. 10  
Stand installation

**5 Start-up**

**5.3 Unlocking the transport protection**

**Fig. 11:** The front window counterweight [1] is secured to the device backpanel to protect it from transport damage.

 **CAUTION – Unlocking the counterweight!**

The counterweight at the device backpanel compensates for the weight of the front window.

The front window must not be moved unless:

- the counterweight has been unlocked so that it can move freely,
- the protective packaging has been removed from the front window,
- the device frame has been installed safely on a sufficiently stable substructure or onto a stand.

**Crushing hazard - after unlocking, keep hands and fingers away from the motion range of the counterweight!**

**To unlock the transport protection:**

- Remove the four retaining screws (position: see arrows).
- Keep the counterweight retaining screws for later transports.

**5.4 Levelling the cabinet**

The cabinet should be levelled only after it has been positioned.

1. Remove transport protection (vinyl) from the workplate or from the workplate.
2. Place the workplate onto the front and rear support rails in the sample chamber with the wide perforated track facing the front window.
3. **Devices without stand:** Place a bubble level onto the workplate (segments) and align the stand until the level indicates an absolutely horizontal position in all directions.
4. **Devices with optional stand:** Place a bubble level onto the workplate and adjust the four stands until the level indicates an absolutely horizontal position in all directions. Proceed the elevating adjustment from right to left and from rear to front.

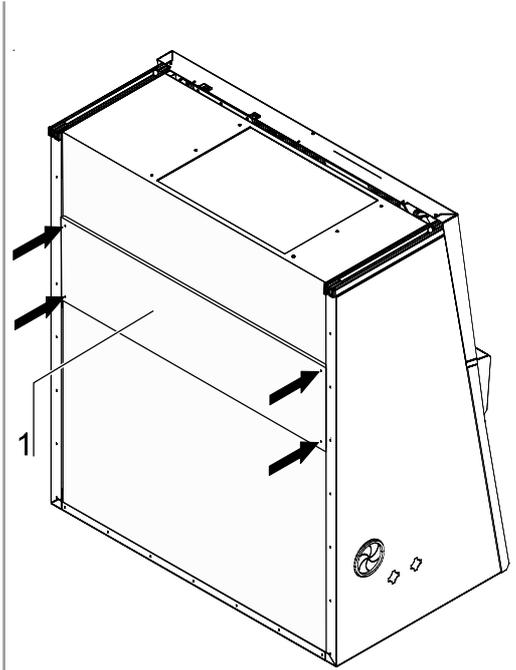


Fig. 11  
Unlocking the transport protection

**5**

**Start-up**

**5.5 Power supply connection**



**WARNING – High voltage!**



**Contact with current-carrying components may cause a lethal electric shock.**

**Before connecting the device to the power supply system, check plug and power supply cable for possible damage.**

**Do not use damaged components to connect the device to the power supply system!**

**Establishing the power supply connection:**

1. Before connecting the device to the power supply system, check to see if the voltage of the outlet corresponds with the specifications on the nameplate of the device. If the ratings given for voltage (V) and maximum current (A) do not match, the device must not be connected to the power supply system.
2. Connect the grounding plug of the device to a properly grounded and fused outlet.
  - The outlet must be fused separately using a fusible link T 16 A or using a circuit breaker B 16.
3. Make sure that the power cable is routed away from the counterweight and cable guide. For this purpose, the power cable can be secured to the device ceiling using the enclosed adhesive bases and cable ties (see installation instructions).
4. Make sure that the power supply line is not subjected to tensile or compressive force.

**Installation of the power supply connection:**

To protect from accidental switch-off, the power supply outlets should be located out of casual reach and must be accessible only to authorized persons. Ideally, the outlet should be located above the biological safety cabinet.

The power supply cable plug is the interruption device in all poles.

**Connecting the equipotential bonding:**

If the device sample chamber is supplied with media (gas, water, etc.), the on-site equipotential bonding must be connected to the main ground of the device (see service instructions).

**Initialization routine:**

Upon connection to the power supply system, the device control passes through an initialization routine and switches the device to OFF mode (the right indicator segment of the display shows a dot to indicate that voltage is present).

The biological safety cabinet is now ready for operation and can be operated using the keys.

**Initial start-up:**

After the initialization routine, the calibration routine is started after the first connection to the power supply system:

- The display alternatingly shows "CAL" and the remaining routine time. The entire calibration run takes approximately 30 minutes.

**5****Start-up**

- The routine starts automatically when the front window is in the work position and if the air flows freely and steadily. If the airflow is disturbed during this run time, the process is cancelled and the calibration routine is restarted.
- To complete the routine, the determined parameters for safe operation and the alarm limits are stored automatically.

**NOTE – Initial operation!**

**According to applicable national standards and regulations, the calibration routine is no substitute for a start-up performed by an authorized service technician.**

**5****Start-up****5.6 Installation test**

Do not operate the device before an initial operation with installation test has been performed after the final installation of the device.

- The installation test must be performed in accordance with the specifications of EN 12469 / 2000. The cabinet may be operated as a Class II microbiological biological safety cabinet, in accordance with EN 12469 / 2000, if the device functions or function patterns listed below were checked and if the test results are within the safety value tolerances specified by the manufacturer in Annex F:
  - Electrical safety test
  - Inflow velocity test
  - Downflow velocity test
  - HEPA filter leakage test
  - Airflow control test
- A repeat test must also be performed after repairs to the device or after considerable changes (more than 5 cm) to the location of the device.
- The operator must prepare a test report or request a written test report from the authorized test service.

**NOTE – Safety warranty!**

**The operational safety of the device, particularly the personal and material protection, are guaranteed only if all safety functions of the device have been tested and approved.**

**Thermo Fisher Scientific will not warrant the operational safety if the device is operated without performance of the required installation test or if the installation test and repeat test are not performed by adequately trained and authorized personnel!**

**NOTE – Device hygiene!**

**The initial operation with subsequent installation test does not include any decontamination measures. For operation in the work process, the sample chamber of the device and the accessories required for the work process must be disinfected and cleaned in accordance with the hygiene guidelines set forth for the application.**

**6 Handling and control**

**6.1 Operating panel**

**Fig. 12:** The operating panel is the major display and operating element and has been divided into three functional units:

16.3

- Display [1], keys [2] - [7], status indicators [8] - [18]

**6.1.1 Functional units**

**Display, Fig. 12:**

[1] Display for numbers and text:

- normal operation: operating hours of the device,
- safe work mode: downflow and exhaust air velocities,
- calibration routine: status of the calibration function,
- device-controlled UV disinfection (optional): remaining disinfection time.

**Keys, Fig.12:**

The keys are used for enabling / disabling device functions:

- [2] Key for switching the device on / off (switch-off only in standby mode, see Section 6.3).
- [3] Operating data key with dual function:
  - Indicating operating data:  
Press the key to switch between the data: Operating hours, downflow and exhaust air velocities in the safe work mode.
  - Enabling (I) / disabling (0) the alarm acknowledge function:  
In the OFF mode, keep the key depressed for approx 5 second. The display momentarily shows the operating hours, then the switching state:  
I = alarm acknowledge function enabled  
0 = alarm acknowledge function disabled  
Within the scope of the EU (EN12469:2000), the alarm acknowledge function is disabled upon delivery of the device.
- [4] Key for switching the sample chamber illumination on and off.
- [5] Key for switching the power supply of device-integral outlets on and off (the LED indicates that voltage is present).
- [6] Key for switching UV disinfection on and off (the yellow LED indicates that the UV disinfection routine has been activated; if the optional UV lamp is not installed, this key has no function).
- [7] Key for acknowledging the audible alarm.

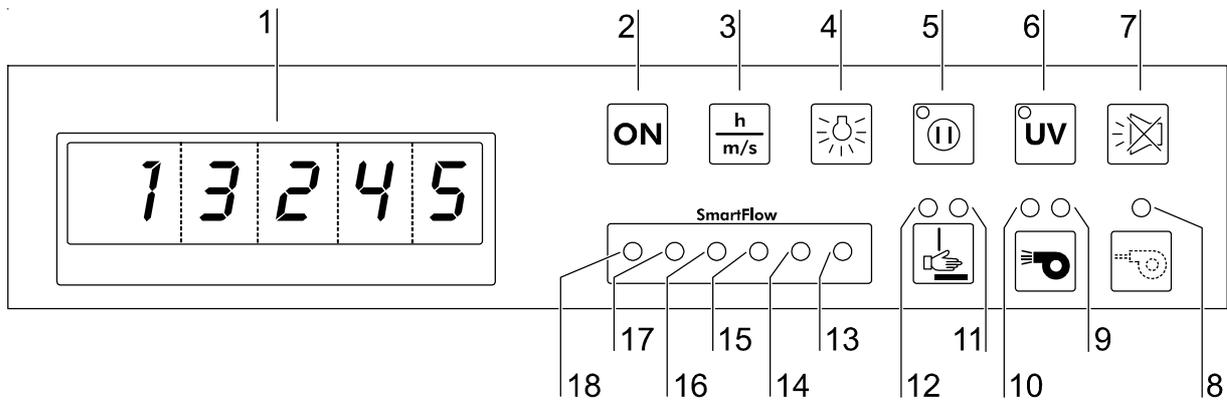


Fig. 12  
Operating panel

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**6**

**Handling and control**

**Status indicators, Fig. 12:**

- [8] The air system is operated at reduced capacity (the yellow LED is illuminated),
- [9] Airflow **is not** steady (the red LED is illuminated),
- [10] Airflow **is** steady (the green LED is illuminated),
- [11] Front window **is not** in work position (the red LED is illuminated),
- [12] Front window **is** in work position (the green LED is illuminated).

**SmartFlow display, Fig. 12:**

The SmartFlow Indicator displays the compensation capability of the exhaust control, with window in working position and blower on. The LEDs that illuminate in pairs indicate the following:

- [18] green + [17] green      sufficient compensation capability
- [16] yellow + [15] yellow    compensation capability is depleted
- [[14] red + [13] red          window outside working position or air velocity outside alarm range



**NOTE – Compensation capability!**

**If the display is steady yellow-yellow, there is a possibility that the filters of the device are fully loaded. In this case, the technical service should be informed.**

**6.1.2 Display during calibration routine**



**NOTE – Calibration routine!**

**The calibration routine is started only upon the initial operation.**

The routine run takes approximately 30 minutes. During this time, the display alternately shows **cal** and the remaining time. If the calibration routine cannot be started due to failures, the display shows **cal** permanently.

**6.1.3 Display during UV disinfection**

If a UV lamp is installed, the display alternately shows **dis** and the remaining disinfection time.

**6 Handling and control**

**6.1.4 Failure messages**

Failure messages are shown on the display as text/number combinations with the codes ER 3 to ER 7. If one of these codes appears on the display, contact Technical Service immediately.

**6.2 Device start-up**

- Fig. 14:** Switch the device on, keep the **ON** key [2] depressed until:
  - the blowers start (audible blower operation),
  - the status indicators (LEDs) [9] - [12] illuminate.

 **NOTE – Switch-on!**

**A time delay of several seconds may occur between key actuation and device response.**

- Move the front window to the work position. The correct position is reached when the green status indicator **FRONT WINDOW IS IN WORK POSITION** [12] is illuminated. The side guide rails have markings that define the lower edge of the front window; these markings can be used as an additional orientation aid.
- Wait until the green status indicator **AIRFLOW IS STEADY** [10] is illuminated.
- The device is ready for operation.

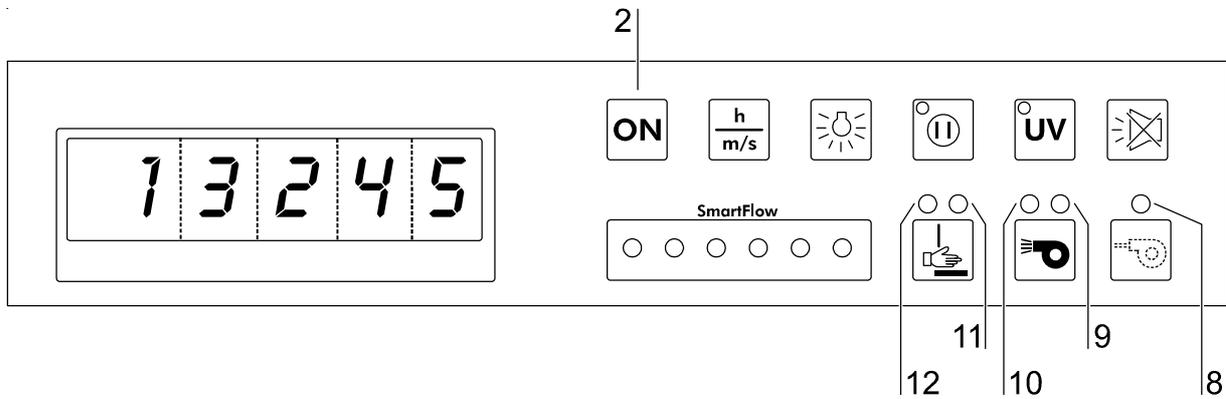


Fig. 14  
Display upon start-up

### 6.3 Description of the operating modes

The following operating modes exist for the device:

- **Calibration mode (after initial start-up)**
- **OFF mode**
- **Window open mode**
- **Work mode**
- **Standby mode**
- **UV mode**

**OFF mode:** Designates the idle state of the device.

- The device is switched off (air system blowers are switched off).
- The sample chamber illumination is enabled.
- The internal power supply within the sample chamber is enabled:
  - If the internal power supply is activated, the yellow status indicator **INTERNAL POWER SUPPLY ACTIVATED** is illuminated.

**Window open mode:** Designates the state in which the window is open and positioned outside of the work position. To install or remove auxiliaries, the front window can be moved to the maximum opening position. For cleaning, the front window can be lowered (see also Section 4.5 / Fig. 6, P. 21).

- The air system blowers are switched on:
  - The red status indicator **AIRFLOW VOLUME STEADY** is illuminated.
- The front window is not in the work position:
  - The red status indicator **FRONT WINDOW NOT IN WORK POSITION** is illuminated.
- The sample chamber illumination is enabled.
- The internal power supply is enabled:
  - If the internal power supply is activated, the status indicator **INTERNAL POWER SUPPLY ON** is illuminated.

**Work mode:** Ensures personal and material protection. In this operating state, the work process is carried out in the sample chamber. Work mode is active when the front window is in the work position and the air system is operating steadily.

- The front window is in the work position:
  - The green status indicator **FRONT WINDOW IS IN WORK POSITION** is illuminated.  
The markings on the side guide rails and the lower edge of the front window are at the same height.
  - No audible alarm signal.
- The air system blowers are switched on to ensure steady airflow:
  - The green status indicator **AIRFLOW STEADY** is illuminated.
- The sample chamber illumination is enabled.
- The power supply for the sample chamber outlets is enabled:
  - If the internal power supply is ON, the yellow status indicator **INTERNAL POWER SUPPLY ACTIVATED** is illuminated.
- The switching state of the potential-free contact (monitor contact) is pass (if e.g. the gas supply solenoid is driven via this contact, gas is supplied in this mode only).
- The display can show values for: operating hours, downflow velocity and exhaust air velocity.

**6****Handling and control**

**Standby mode:** The front window can be lowered to seal the sample chamber. The air system output is reduced to match the lower air requirement.

- The front window is closed:
  - The air system operates at reduced output.
  - The red status indicator **FRONT WINDOW NOT IN WORK POSITION** is illuminated.
  - The yellow status indicator **AIRFLOW REDUCED** is illuminated.
  - The red status indicator **AIRFLOW NOT STEADY** is illuminated.
- The sample chamber illumination is enabled.
- The internal power supply in the sample chamber is enabled:
  - If the internal power supply is ON, the yellow status indicator **INTERNAL POWER SUPPLY ACTIVATED** is illuminated.
- The biological safety cabinet can be switched off (in OFF mode):
  - Keep the ON key depressed until all indicators are off.

**UV mode:** For running the UV disinfection routine, the front window is completely lowered to protect against UV radiation. The routine cannot be run until the front window is in the "closed" position.

- The UV disinfection routine is activated:
  - The yellow status indicator **UV DISINFECTION ROUTINE ACTIVATED** is illuminated until the preset time for the routine has elapsed. Then, the UV lamps are switched off automatically, and the status indicator is switched off.
- The sample chamber illumination is disabled.
- The internal power supply in the sample chamber is disabled.
- The integral UV lamp (optional) is enabled.
- The power supply for the UV disinfection adapter (optional) is enabled.

**7**

**Operation**

**7.1 Hygiene preparations for the sample chamber**

The sample chamber surfaces and the accessories required for the work process must be disinfected and cleaned in accordance with the hygiene guidelines set forth for the application.

**7.2 Loading the sample chamber**

Installing auxiliaries:

1. Move the front window to the maximum opening position and switch the blowers on.
2. Install auxiliaries within the workplate working range.
3. Move the front window to the work position (the green status indicator **FRONT WINDOW IN WORK POSITION** is illuminated) and wait until the airflow has stabilized (the green status indicator **AIRFLOW STEADY** is illuminated).



**CAUTION – Operational safety!**

**The personal and material protection is ensured only if the airflow system of the device is working properly.**

**If the alarm system issues failure messages when the front window is in the work position, stop all applications that may release harmful aerosols!**

4. Load the work surface with samples.
5. For work intermissions or for extended experimental phases without manual intervention, switch the device to standby mode.

**7.3 Response to failure messages**

Failure messages are displayed in form of text/number combinations with a code between ER 3 to ER 7 (see Section 6.1.4). If one of these codes is displayed, contact the Technical Service of Thermo Fisher Scientific immediately.

To isolate the cause of the failure, the operating personnel must perform only the following tests and measures:

- Check to see if the exhaust air opening on top of the cabinet is blocked.
- Ensure that the on-site exhaust air system is activated.
- Close doors and windows in the laboratory to prevent drafts.
- Switch off devices in the vicinity of the biological safety cabinet that cause air turbulence or emit excessive heat.
- Open flames in the sample chamber may impair airflow conditions.

**7**      **Operation**

**7.4 Work rules**

The observance of work rules ensures a minimum of operational safety when handling the biological safety cabinet.

**Before starting an operation:**

- Take off jewelry.
- Put on required personal protective gear, e.g. hand, face, or body protection.
- Clean and disinfect sample chamber surfaces at regular intervals.

**During operation:**

- Place samples only within the defined work area of the workplate.
- Do not place unnecessary items into the sample chamber.
- Use only disinfected and cleaned accessories for the work process.
- Do not cause air turbulence by quick hand, arm or body movement in the sample chamber or in front of the work opening.
- Do not place accessories into the sample chamber that cause air turbulence or emit excessive heat.
- Do not block air circulation at the ventilation slots of the workplate.

**Sitting posture during work:**

**Fig. 15:** To prevent risks to health, a height-adjustable working chair with an adjustable seat back should be used during extended work periods at the biological safety cabinet.

**A** When the forearm rests on the armrest, it should be in a nearly horizontal position.

**B** When the upper leg is in a horizontal position, the angle between upper and lower leg should exceed 90°.

To ensure a compensation between floor and sitting height, a footrest (DIN 4556) should be used. The minimal effective surface of the footrest should be 45 x 35 cm.

**C** The slope should be adjustable within a range of 5° to 15°.

**D** The adjustable height should extend to a minimum of 11 cm above the floor.

**After finishing an operation:**

- Remove samples from the sample chamber and store them properly.
- Clean and disinfect the sample chamber surfaces, including the workplate and the floorpan. Clean and disinfect all accessories.

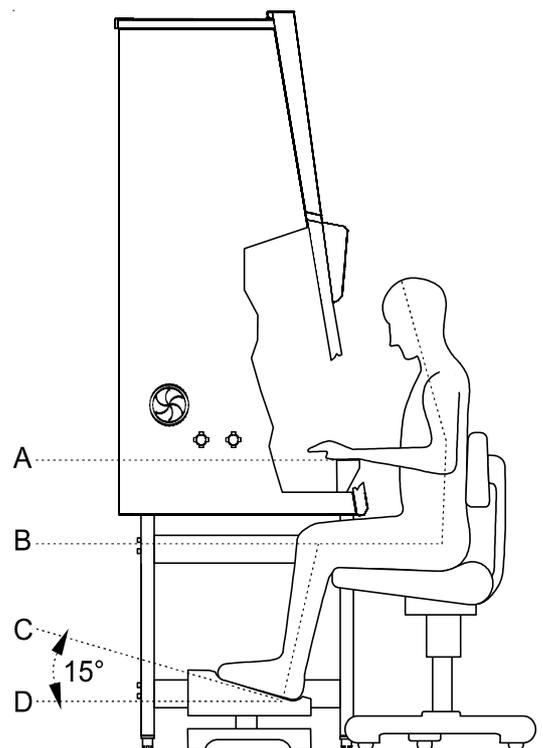


Fig. 15  
Sitting posture

**8****Shut-down****8.1 Interrupting an operation**

To interrupt a work process:

1. Remove all samples from the biological safety cabinet and store them properly.
2. Remove accessories from the sample chamber and clean and disinfect them.
3. Clean and disinfect the sample chamber surfaces, the workplate, and the floorpan.
4. Switch the device to standby mode: Close the front window and keep the ON key depressed until the indicators are off (the right indicator segment of the display shows a dot to indicate that voltage is present).



**NOTE – Blower switch-off!**

**For safety reasons, the blowers can be switched off only when the front window is closed.**

**8.2 Shutting the device down**

If the device is not to be used or stored for an extended period of time, it must be completely decontaminated.



**WARNING – Decontamination measures!**

**To shut the device down, the sample chamber must be disinfected completely and the plenum, including the filters, must be sterilized using formaldehyde.**

1. After the device has been decontaminated, close the front window completely.
2. Disconnect the device from the power supply system.

**9****Cleaning and decontamination****9.1 Decontamination procedure**

Several procedures can be applied for decontaminating the biological safety cabinet.

Which procedure is selected, depends on:

- the potential risk imminent in the agents,
- the degree of purity required by an experiment or by a work process.

**Possible decontamination procedures:**

**Wipe/spray disinfection:** is the standard disinfection procedure for cabinets used for microbiological experiments.

**UV disinfection:** is particularly suited as an intensifying additional disinfection after a wipe/spray disinfection.

**Sterilization with steam:** can be used for treating the removable stainless steel components. Examples of autoclavable components are the bezels of the UV lamps, the workplate or workplate segments, the armrests and the protective grid (see Section 9.6 / 9.7).

**Disinfection with formaldehyde:** can be performed if a sterile sample chamber is required for the work process. This sterilization procedure is mandatory:

- when filters are replaced,
- when the device is shut down,
- when the device is discarded.

**9.2 Wipe/spray disinfection**

The wipe/spray disinfection is performed in three stages:

- pre-disinfection,
- cleaning,
- final disinfection.

Recommended disinfectants:

**NOTE – Compatibility!**

**Chloride-containing disinfectants may damage some surfaces, Therefore, use only chloride-free disinfectants or a disinfectant with a low enough chloride content to have been proved harmless for stainless steel finishes!**

**Disinfectants with an alcohol content of more than 70 % may cause embrittlement of plastic components after extended exposure. Use only disinfectants with a low alcohol content. When using a disinfectant with an alcohol content of more than 70 %, the release limit of 200 g within 2 hours must not be exceeded.**

**Also suited are disinfectants based on quaternary ammonium compounds.**

**9****Cleaning and decontamination****Predisinfection:**

1. Remove all samples from the sample chamber and store them properly.
2. Remove accessories from the biological safety cabinet and disinfect them using the disinfection procedure recommended by the manufacturer.
3. The workplate and stainless steel components can be removed from the sample chamber and disinfected separately.
4. For predisinfection, spray disinfectant on all sample chamber surfaces or wipe the surfaces using disinfectant.
5. Do not remove the optional UV lamps from the sockets; wipe them thoroughly using a damp cloth.
6. Switch the device to work mode, move the front window to the work position.
7. Allow disinfectant to react as recommended by the manufacturer, then operate the biological safety cabinet for at least 15 to 20 minutes in the work mode so that released aerosols can be absorbed by the filters.

**Cleaning:**

1. Remove dirt residues and deposits thoroughly using a solution of tepid water and commercially available dishwashing agent.
2. Wipe the surfaces clean using a clean cloth and plenty of clear water.
3. Remove the cleaning liquid from the floorpan and wipe all sample chamber surfaces dry.

**Final disinfection:**

1. Again, spray disinfectant on all sample chamber surfaces or wipe the surfaces clean using disinfectant.
2. Allow disinfectant to react as recommended by the manufacturer.

**9****Cleaning and decontamination****9.3 UV disinfection after a wipe/spray disinfection**

A UV disinfection can be performed either by using the optional integral UV lamps or by using a mobile UV device.

**9.3.1 UV disinfection using the integral UV lamp****To start the UV disinfection routine:**

1. Close the front window completely, the air system operates in the reduced mode (yellow LED illuminated).
2. Start UV disinfection using the **UV** key at the operating panel:  
Keep the **UV** depressed until the display alternatingly shows dIS and the remaining disinfection time.

**To interrupt / cancel the UV disinfection routine:**

1. Press the **UV** key (the display shows the operating hours).
2. Slide the front window up.

**9.3.2 UV disinfection using a mobile UV device (optional)**

To control the disinfection routine of a mobile UV device with the biological safety cabinet software, ensure that the connecting plug of the UV device is compatible with the UV disinfection adapter of the biological safety cabinet.

**To start the UV disinfection routine:**

1. Position the mobile UV device centered on the work area and connect it to the UV disinfection adapter.
2. Close the front window completely, the air system operates in the reduced mode (yellow LED illuminated).
3. Start UV disinfection using the **UV** key at the operating panel:  
Keep the **UV** depressed until the display alternatingly shows dIS and the remaining disinfection time.

**To interrupt / cancel the UV disinfection routine:**

1. Press the **UV** key (the display shows the operating hours).
2. Slide the front window up.

**9.3.3 Changing UV disinfection time**

The UV disinfection time is preset; this setting can be changed, if required:

1. Switch the cabinet on and move the front window to the work position.
2. Keep the UV key depressed until the preset time is displayed.
3. To increase the time:  
Press the **INTERNAL POWER SUPPLY** key. Each pressing of the key increases the time by 30 minutes.
4. To reduce the time:  
Press the **INTEGRAL SAMPLE CHAMBER ILLUMINATION** key. Each pressing of the key reduces the time by 30 minutes.
5. To save the values:  
Press the **UV** key.  
The display shows the operating hours again.

**9**

**Cleaning and decontamination**

**9.4 Disinfection with formaldehyde**

**Procedure:**

For gas disinfection, formaldehyde is evaporated in the tightly sealed sample chamber. The quantity of the formaldehyde used depends on the sample chamber volume of the cabinet version to be disinfected (see Technical Data). Per cubic meter of sample chamber volume, at least 5 g formaldehyde must be evaporated with 20 ml water (corresponds with 25 ml of a 20 % formaldehyde solution). The formaldehyde evaporates immediately when its boiling point is reached. The required reaction time is at least 6 hours. After the required reaction time, the formaldehyde should be neutralized by evaporating a 25 % ammonium solution (10 ml per cubic meter of sample chamber volume).

**Ambient conditions and accessories:**

The temperature at the cabinet location should be approx 21 °C, the relative humidity should be between 60 and 85 %. To evaporate the solution, a heating device with a container is required.



**NOTE – Disinfection procedure!**

**A disinfection with formaldehyde must be performed in accordance with the specifications of EN 12469.**

**As this procedure has considerable risks, it must only be performed by specially trained and authorized service personnel!**

**9.5 Cleaning the exterior surfaces**

Wipe the exterior surfaces of the device clean using a solution of TAP water and commercially available dishwashing agent. Then, wipe the exterior surfaces dry using a soft, clean cloth.

**9.6 Cleaning the front window**

For cleaning (and disinfection using the wipe disinfection procedure), the front window can be lowered beyond the closing position (see Section 4.5). The gap between the light dome and the front window upper edge ensures that the upper section of the window can be cleaned or disinfected. Clean the front window using a commercially available window cleaner.

**9** **Cleaning and decontamination**

**9.7 Cleaning the floorpan**

Clean the floorpan using a solution of tepid water and commercially available dishwashing agent.

1. Remove the workplates from the sample chamber.
2. Remove dirt residues and deposits thoroughly.
3. Wipe the floorpan clean using a clean cloth and plenty of clear water.
4. Remove the cleaning liquid from the floorpan and wipe the floorpan surfaces thoroughly clean.



**NOTE – Material residues!**

**After cleaning, make sure that all cleaning materials have been removed completely from the floorpan.**

5. Reinstall the workplates.

**9.8 Cleaning the protective grid**

**Fig. 16:** The multi-segment protective grid is retained in the installed position between support surface and airduct wall by its own tension.

1. To remove a grid segment [2], push the retaining tab [1] down until the grid segment can be removed from below the counterholder [3] of the wall.
2. To install the grid segment [2], first place it behind the fixed points [4], then push the retaining tab [1] down and against the counterholder [3] of the wall so that the counterholder engages in the tab.



**NOTE – Inlet air protection!**

**Do not operate the device without inlet air protection. Prior to any start-up of the device, make sure that the inlet air protection is installed!**

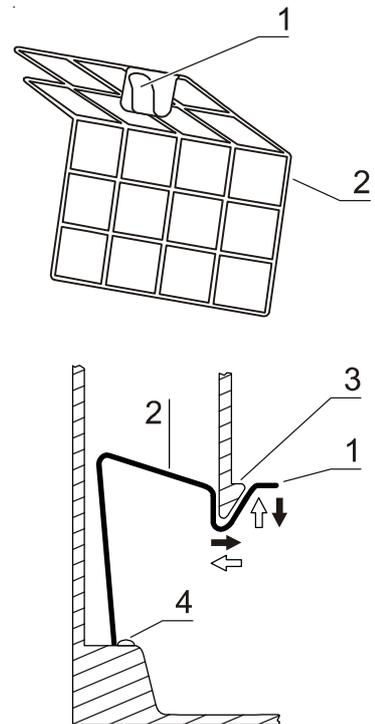


Fig. 16  
Protective grid segment

**10**

**Maintenance**

**10.1 Inspection**

The SmartFlow Indicator, the test routine for the biological safety cabinet, determines the cabinet's system status by way of adjusting various device parameters.

- An inspection of the device should be performed if the SmartFlow Indicator displays steady 2 yellow LED`s.
- Regardless of the SmartFlow Indicator, the biological safety cabinet should be inspected annually.

The annual inspection comprises the following checks:

- Electrical safety in accordance with national regulations.
- Functional test of the device.
- Checking all components for possible damage.
- Checking the filter state.



**NOTE – Perforated plate!**

**The perforated plate at the sample chamber ceiling serves as the protection of the down-flow filter and prevents refluxing.**

**While scanning the filter surface for a leak test, the perforated plate must be installed.**

- Checking the airflow conditions.
- Repeat test in accordance with EN 12469 / 2000.

**10.2 Service**

**HEPA filters:**

As the filter replacement is an interference with the safety system of the device, filters must only be replaced by Thermo Fisher Scientific or by adequately trained and authorized service personnel.



**WARNING – Filter replacement!**

**For any service work in a potentially contaminated section of the biological safety cabinet, a declaration of non-objection by the manufacturer must be presented.**

**10 Maintenance**

**10.2.1 Sample chamber illumination**

**Fig. 18:** The sample chamber is illuminated by one or two fluorescent tubes (model MSC 0.9, 1.2, 1.5, 1.8). The spring-loaded sockets of the fluorescent tube [2] are installed to the light dome mounting frame in the sample chamber.

1. Switch the device off, disconnect it from the power supply system and protect it against accidental reconnection.
2. Move the front window down all the way beyond the frame (SmartClean position) to ensure a sufficient gap between window upper edge and light dome.
3. The fluorescent tubes are retained by rotatable sockets. Rotate the tube carefully by 90° into the removal position and remove it from the socket.
4. Insert the new tube und rotate it into the contact position.

**10.2.2 Optional UV lamps**

**Fig. 17:** The optional, device-integral UV lamp [1] is installed to the sample chamber ceiling immediately behind the front window. The UV lamp should be replaced after 1500 operating hours.

1. Switch the device off, disconnect it from the power supply system and protect it against accidental reconnection.
2. Move the front window to the maximum opening position.
3. Wear protective gloves to prevent skin fat residues from burning into the lamp tube.  
The UV lamp is installed in rotating sockets. To remove, rotate the lamp counter-clockwise to disengage the latch and remove it from the sockets.
4. To install, slide the lamp contact pins into the rotating socket grooves and rotate the lamp clockwise to latch the sockets.

**10.3 Retrofitting and repairs**

External communication systems, e.g. failure report systems or components for supplying media such as gas solenoid valves, can be retrofitted and integrated into the device control.



**NOTE – Retrofitting and repairs!**

**All retrofitting and repair works are interferences with the safety system of the device. Particularly modifications to the filter system and resulting changes of the airflow may impair personal and material protection. Such work must be carried out only by authorized service personnel.**

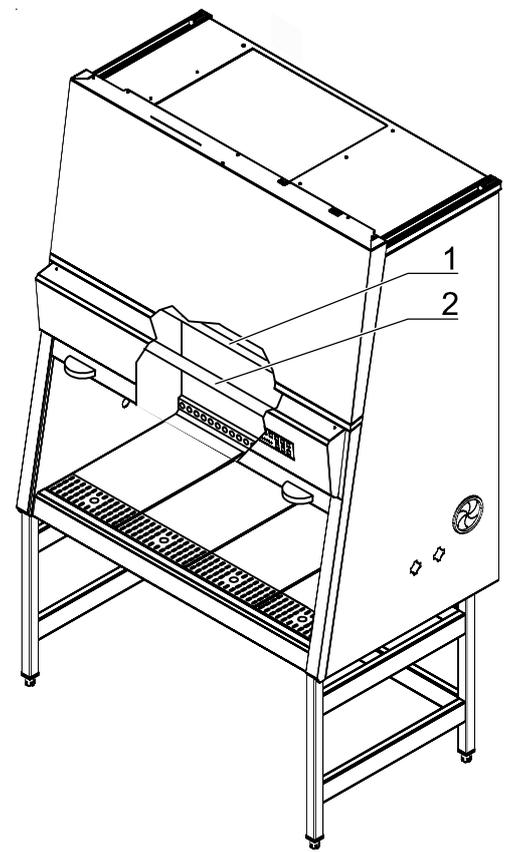


Fig. 17  
UV lamp replacement

## 10.4 Exchanging SmartPorts



### **NOTE – Contamination**

**In order to prevent contaminated particles escaping from the utility chamber, the unit must be switched on in order to exchange the SmartPorts.**

**The SmartPorts are removed inwards into the utility chamber.**

1. First remove the inner grommet of the SmartPort in the utility chamber inwards from the side panel opening.
2. Then remove the outer grommet of the SmartPort in the utility chamber inwards from the side panel opening.
3. Disinfect both grommets in the utility chamber and take them out of the utility chamber.
4. Insert new outer grommet in the side panel opening from the outside.
5. Insert new inner grommet in the side panel opening from the inside.

**11**

**Disposal**

**11.1 Disposal procedure**

Discarded cabinets or device components contain reusable materials. All components with the exception of the HEPA filters can be discarded after having been thoroughly cleaned and disinfected. The HEPA filters must be discarded in accordance with the applicable national and state regulations for special solid waste.



**CAUTION – Contamination hazard!**

**As the device can be used for processing and treating infectious substances, it may be contaminated.**

**Prior to disposal, the complete device with filters must be decontaminated by performing a formaldehyde sterilization!**



**Recyclable materials!**

<b>Component</b>	<b>Material</b>
Printed circuit boards	Enclosed electrical components coated with various plastics, mounted on epoxy resin-bound boards.
Plastic components, general	Note material labeling
Exterior housing	Steel, painted
Device backpanel	Stainless steel/steel, painted
Front window	Multi-layer safety glass
Operating panel and indicator foil	Polyethylene
Workplates	Stainless steel
Armrests	Stainless steel
Diffusor	Aluminium, anodized

**11****Disposal****WEEE Compliance:**

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:



Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be discarded or recycled through them. For further information on Thermo Scientific's compliance with these Directives, contact the recyclers in your country, and information on Thermo Scientific products which may assist the detection of substances subject to the RoHS Directive at [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS).

**12**

**Technical data**

Dimensions					
Description		MSC 0.9	MSC 1.2	MSC 1.5	MSC 1.8
<b>Exterior dimensions</b>					
Width	mm	1000	1300	1600	1900
Depth	mm	802			
Height	mm	1522			
<b>Interior dimensions</b>					
Width	mm	900	1200	1500	1800
Depth	mm	630			
Height	mm	780			
<b>Front window</b>					
Working position	mm	200			
Opening max.	mm	535			
<b>Working area height, fixed height stand</b>					
Seat position	mm	750			
<b>Stand height, fixed height stand</b>					
Stand	mm	680			
<b>Side wall feed throughs</b>					
Diameter	mm	23			
Distance lower edge	mm	227			
<b>SmartPort feed throughs</b>					
Diameter	mm	79			
Distance lower edge	mm	290			
<b>Distance from backpanel</b>					
Bushing 1	mm	275			
Bushing 2	mm	376			
SmartPort	mm	200			

## 12

## Technical data

Volume, weights, and loads					
Description		MSC 0.9	MSC 1.2	MSC 1.5	MSC 1.8
<b>Volume</b>					
Unit volume	m <sup>3</sup>	1.1	1.4	1.7	2.1
Floorpan	l	15	20	25	30
<b>Weights</b>					
Cabinet	kg	170	200	230	280
Stand	kg	24	26	28	30
<b>Loads</b>					
Max. load per working area module	kg	25			
Max. load on overall working area	kg	50			

Ambient conditions					
Description		MSC 0.9	MSC 1.2	MSC 1.5	MSC 1.8
<b>Temperature</b>					
Max. ambient temperature during operation	°C	40			
Min. ambient temperature during operation	°C	10			
<b>Humidity</b>					
Max. humidity / operation	% r.H.	90, non-condensing			
Max. humidity / storage	% r.H.	95			
<b>Heat dissipation to environment</b>					
Room temperature 20 °C	kJ/s	0,15	0,2	0,28	0,34
<b>Room temperature rise</b>					
Above room temperature with window closed	°K	< 2	< 2	< 2	< 2
<b>Ergonomics</b>					
Noise level	dB(A)	55		59	
		The noise level was determined in accordance with EN ISO3744. The sound pressure level was measured at a distance of 1 m in front of the working opening. The measurement uncertainty is within a range of ± 2 dB.			

**12**

**Technical data**

Electrical data					
MSC-Advantage		MSC 0.9	MSC 1.2	MSC 1.5	MSC 1.8
<b>Voltage</b>					
Rated voltage	V	1/N/PE AC, 230 V - 50-60 Hz			
Blower voltage	V	48 V / DC			
<b>Current</b>					
Power consumption max.	A	7.3		8.7	
Leakage current IEC1010, EN 61010	mA	< 3.5			
Motherboard fusing	A	2 x T 16 A			
Outlet fusing	A	2 x T 5 A			
On-site fusing	A	Circuit breaker B16 / Fuse T 16 A			
<b>Power</b>					
Power input max.	W	1700.0		2000.0	
<b>Protection</b>					
Protection class		I			
Protection type		IP 20			
Overvoltage category (IEC 1010, EN 61010)		II			
Contamination degree (IEC 1010, EN 61010)		2			
<b>Connecting lines</b>					
Mains connection		Cable (3.7 m)			

**12**
**Technical data**

<b>Airflow system</b>					
<b>Description</b>		<b>MSC 0.9</b>	<b>MSC 1.2</b>	<b>MSC 1.5</b>	<b>MSC 1.8</b>
<b>Airflows / Airflow velocities</b>					
Inflow	m/s	0.45			
Downflow	m/s	0.32			
<b>Air volume</b>					
Overall volume flow	m <sup>3</sup> /h	914	1218	1523	1827
Downflow volume flow	m <sup>3</sup> /h	622	829	1037	1244
Exhaust air volume flow	m <sup>3</sup> /h	292	389	486	583
<b>Filters</b>					
Type		HEPA (H 14 according to DIN EN 1822)			
Material		Glas fiber fleece			
Separability in MPPS	%	99.995			
Separability at 0,3 µm particle size	%	99.999			
<b>Downflow</b>					
Width	mm	915	1220	1525	1830
Depth	mm	457			
Height	mm	94			
<b>Exhaust air</b>					
Width	mm	610	610	610	915
Depth	mm	457			
Height	mm	117			



**14 Certificate of decontamination**



Notification no.	Notification date	Page 1/1
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**Declaration**

**Thermo Electron LED GmbH**  
**Customer Center Germany**  
**Robert-Bosch-Str. 1**  
**D-63505 Langenselbold**

**Telephone 0 8001 112 110**  
**Telefax 0 8001 112 114**  
**www.thermofisher.com**

Invoice recipient / Customer no.			Location address / Forwarding address		
Call type	Region	ID of technician	Name of technician		Appointed date
Order date	by		Customer order no. / PO		Service contract no.
Device description (Type)		Material no. (order no.)	Date of last maintenance	Date of delivery	Customer cost center
Equipment no. (Factory no.)	Serial no.	Service device no.	Date of calibration	Date of start-up	Customer inventory no.

**Safety Declaration**

Dear customer,

When using biological and chemical agents within and outside of devices, hazards to the health of the operating personnel may be present and contamination of the surroundings of the device may occur when service or repair works are carried out. Within the scope of national and international legal regulations, such as

- responsibility of a company for the protection of its employees,
- responsibility of the operator for the operational safety of devices,

all possible hazards must absolutely be prevented. Prior to any calibration, service, and repair works, prior to any relocation of a device, and prior to the shut-down of a device, the device must be decontaminated, disinfected, and cleaned as required by the work to be carried out.

Therefore, we ask you to fill in this certificate of decontamination before you start with the required work.

Yours sincerely,  
Thermo Electron LED GmbH

**Works to be carried out (please mark where applicable)**

Prevented maintenance	<input type="checkbox"/>	Filter replacement	<input type="checkbox"/>
Repair work	<input type="checkbox"/>	Transfer to new location	<input type="checkbox"/>
Calibration	<input type="checkbox"/>	Transport	<input type="checkbox"/>

**Declaration of possible contamination (please mark where applicable)**

The device is clear of biological material	<input type="checkbox"/>	The device is clear of dangerous chemical substances	<input type="checkbox"/>
The device is clear of radioactivity	<input type="checkbox"/>	The device is clear of other dangerous substances	<input type="checkbox"/>
The device is clear of cytostatic agents	<input type="checkbox"/>		

**Certification**

Prior to carrying out the required work, we have decontaminated, disinfected, and cleaned the device as described in the operating instructions of the device and in accordance with nationally applicable regulations. The device does not present any hazards.

**Note**

Date, legally binding signature, stamp

Revision: 1 Thermofisher certified: 18.08.08 MW Status: -Approved Ident-Nr: 50077599E - File name: P50077599E.pro

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Highlighting innovative design features  
and useful applications information for  
**Thermo Scientific Biological Safety Cabinets.**

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# smart notes

► design and innovation



LAMINAR AIRFLOW PRODUCTS

SMARTNOTE 1

## Q Why is a dual blower system better than a single blower system?

# A

A dual blower system ensures personal and product protection, not only on the day of the biological safety cabinet's certification, but every day it is in use.

The balance of inflow and downflow is critical in providing both the personal and product protection characteristic of the Class II biological safety cabinet. Loading of the HEPA filters over time requires regular adjustment of airflows to maintain performance and protection. Traditional biological safety cabinets require the adjustment of a manual damper to balance inflow and downflow, whereas Thermo Scientific biological safety cabinets balance the air automatically through the use of their unique dual blower system.



# Why Thermo Scientific Biological Safety Cabinets?

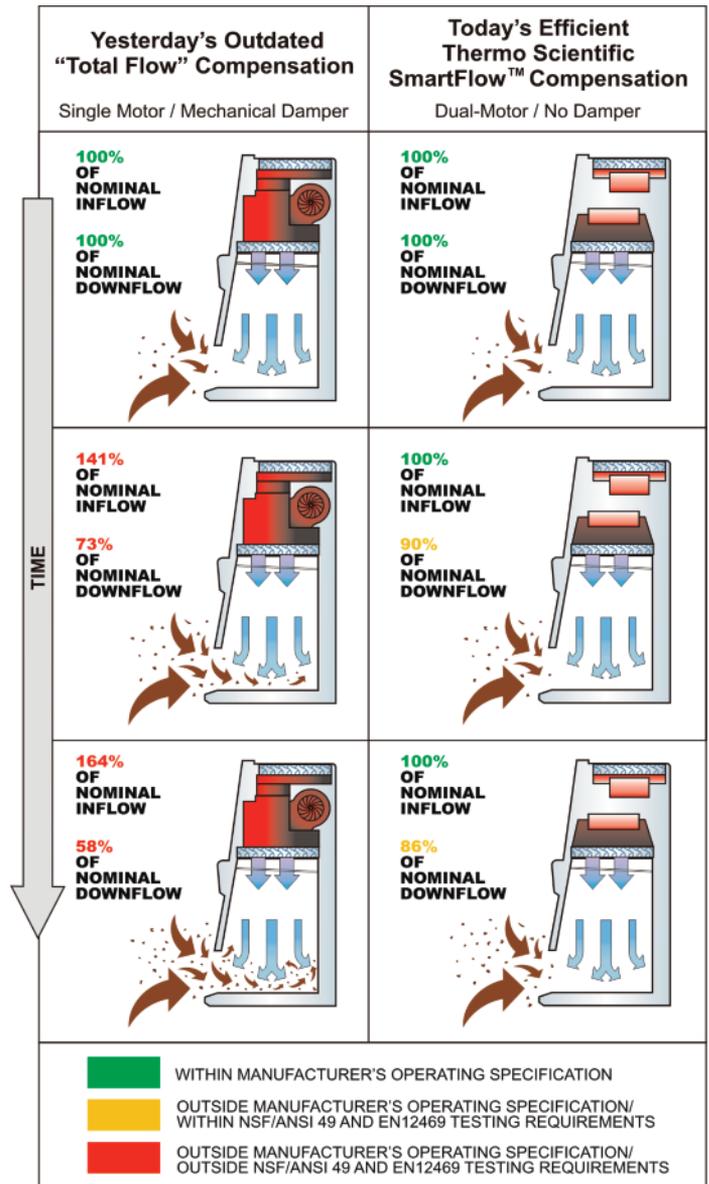
## Yesterday's Outdated Approach

Speed adjustment on a single motor/blower biological safety cabinet only allows adjustment of the total airflow, which is then divided into downflow and inflow by use of a manual air damper. Single motor designs can only maintain total flow without consideration for the allocation of the airflow into the work area or out of the exhaust stream. This outdated design requires a manual damper to adjust the airflow balance, and cannot adjust in real-time to filter loading or airflow blockage. Because this damper is only adjusted during annual certifications, there is greater potential of airflow balance disruptions during routine use of the cabinet.

## Today's Thermo Scientific SmartFlow Approach

Thermo Scientific biological safety cabinets' advanced **SmartFlow™** design uses a dual blower system where the exhaust blower controls and maintains inflow in real-time, assuring a higher degree of personal protection. Simultaneously, the downflow blower automatically balances the downflow air stream as the inflow adjusts, eliminating the need for a manual damper while providing superior product protection.

- 16.5 ► This Thermo Scientific dual blower combination exceeds NSF/ANSI49 and EN12469 requirements – providing constant **confidence and security of real-time airflow** balance that is critical to maintaining both **cleanliness and containment!**



The advantage of the dual blower based Thermo Scientific SmartFlow design is shown here. As the filters load, the total flow compensating/ system with mechanical damper (left) results in increasingly divergent downflow and inflow, while the SmartFlow systems (right) remain within the validated performance envelope. Brown arrows and particulates depict the loss of product protection over time as the airflow balance changes due to filter loading.

See how the Thermo Scientific SmartFlow dual motor design optimally controls airflow velocities.

Learn more at [www.thermoscientific.com/bsc](http://www.thermoscientific.com/bsc)

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Part of Thermo Fisher Scientific

Highlighting innovative design features  
and useful applications information for  
**Thermo Scientific Biological Safety Cabinets.**

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S C I E N T I F I C

# smart notes

► design and innovation



LAMINAR AIRFLOW PRODUCTS

SMARTNOTE 2

## Q Why are airflow alarms an important consideration for Biological Safety Cabinets (BSCs)?

**Airflow alarms will alert the user if there is a problem with containment or product protection.**

Fluctuations in inflow or downflow velocities can disrupt the fragile air balance at the front opening of a BSC. Disruption of the airflow balance can result in sample contamination or inadvertent exposure to hazardous materials. Therefore, it is critical for the BSC user be alerted to these safety risks.

Unlike traditional BSCs, the Thermo Scientific BSC design combines independent DC motors and pressure sensor-based airflow alarms — DAVE (Digital Airflow Verification) — to provide the utmost in product protection and worker safety.



# Why Thermo Scientific Biological Safety Cabinets?

## Yesterday's Outdated Approach



Many BSC manufacturers monitor airflow using a **"Magnehelic" or "Minihelic" pressure gauge**. Difficult to interpret, these devices provide no notification of unstable airflow or specification fallout, with high potential for undetected error.



Airflow can also be measured by **DC motors** that monitor the rpm of the fan and the torque required to achieve the rpm. Though they can be programmed to adjust torque to maintain specifications, they do not provide any alarm if airflow specifications are not maintained.



A **thermal or "hot-wire" anemometer** may also be used to independently measure airflow. Anemometers use a heated wire to measure airspeed, the more air crossing it, the more it's cooled, changing its electrical resistance. While these devices can trigger an audible or visual alarm for airflow specification deviation, they are limited to taking a reading at a single point in the airstream.

## Today's Thermo Scientific DAVE Approach

All Thermo Scientific Class II (Type A2) BSCs incorporate a **pressure sensor-based independent airflow monitoring system** called Digital Airflow Verification (DAVe). Separate sensors measure pressure change across the downflow and exhaust HEPA filters, ensuring accurate overall measurement of both airflows. These measurements are converted into an audible and visual alarm alerting the user to an airflow restriction or excessive airflow variation greater than 20%.



As the first to market with an **ebm-papst Inc. DC motor-based BSC** in 2002, the Thermo Scientific BSC design resolves many deficiencies in traditional cabinets. Our BSCs automatically adjust and maintain airflow specification. The fan control and power supply are independent from the motor and can be replaced without an expensive or disruptive decontamination procedure. World renowned for reliability, these motors are estimated for >100,000 hours (>11 years) of use – double the lifespan of other DC motor designs.



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# Understanding the differences between Class II, Type A2 and Type B2 Biological Safety Cabinets

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**Key words:** *Biological Safety Cabinet, BSC, Class II, A2, B2, NSF, EN12469*

## Introduction

A Class II biological safety cabinet (BSC) is a ventilated containment device found in laboratories around the world. BSCs are used in many applications, including cell culture, pharmaceutical, clinical and microbiological work. Due to the critical nature accomplished inside these commonly used laboratory products, BSCs are regulated through rigorous standards and compliance. Engineered controls are built into the design of BSCs providing protection to the operator, product and environment.

Globally, different regions have their own standards applicable to BSCs, and manufacturers build and test to the criteria set out in these standards.

The two most common standards used globally are the NSF/ANSI 49<sup>1</sup>, which originated in



**Figure 1.** Image of a Class II, Type A2 BSC that accounts for approximately 95% of the global install base of any class or type of BSC (Thermo Scientific 1300 Series BSC pictured).

North America, and EN12469: 2000 Biotechnology—Performance criteria for microbiological safety cabinets<sup>2</sup>, which originated in Europe.

NSF currently recognizes four types of Class II BSCs. Another class is planned to be added in 2017. Classes include:

- A1
- A2
- B1
- B2
- C1 (not recognized until 2017)

The EN12469 standard recognizes one type of Class II BSC, which is generally equivalent to the Class II, Type A2 BSC as specified by NSF (Figure 1).

European Class II and NSF Class II, Type A2 BSC accounts for approximately 95% of the global install base of any class or type of BSC<sup>3</sup>. It is the most commonly used BSC, primarily due to the versatility and high levels of protection offered.

The Class II, Type B2 BSC (commonly known as a B2) is widely used and accepted in North America. B2 BSCs can also be found in the Middle East but rarely in China and other Asian Pacific countries. Toxicology is the main application for a B2. However, within Europe, it is extremely rare to see a Class II, Type B2 BSC used in a laboratory. Applications, such as toxicology work, would see a different approach regarding BSCs, mainly using a “thimble” Type A2 in place of a B2. European manufacturers produce what is known as a Cytotoxic Class II BSC, which is built to DIN12980<sup>4</sup> (Cytotoxic Standard) as well as conforming to EN12469. Ultimately the “European Cytotoxic BSC” is still an A2 type BSC.

Often there is confusion and misconception within the industry as to when to specify or use an A2 or B2 BSC. What type offers better biological containment? What applications can they be used for? Can a Type A2 BSC be used for work with chemicals? These are just some of the questions regularly posed by laboratory professionals when considering a BSC purchase. This application note will explain the differences between types of BSCs and the strengths and weaknesses of these types to educate and clarify some of the confusion surrounding A2 and B2 BSCs.

### Class II BSC similarities

All Class II BSCs provide four types of protection. First, they protect the BSC operator from airborne biological hazards from the BSC work area with an inward flow of air at the front

opening. Second, they protect the laboratory and external environment from hazards inside the BSC work area by filtering the air exhausted or drawn from the BSC. Third, they protect the samples in the BSC from airborne contamination in the laboratory with a downward flow of filtered air inside the cabinet onto the BSC work area. Finally, they help prevent cross contamination within the BSC work area through the use of a flowing and uniform downflow onto the BSC work area.

As we begin to look at the differences between the A2 and B2 types, we should first note that the airflow within the BSC work area is the same for all types of Class II BSCs. There is the inflow being drawn in the front opening but immediately captured into the front intake grille. This provides personal protection. There is the filtered flow of air inside the cabinet, flowing down from the top of the BSC

work area to the work surface, where it splits with half of the air going to the back grille and the other half going to the front intake grille. Smooth and clean downflow provides the product and cross-contamination protection.

Where the four or five types of Class II BSCs differ is in the source of the downflow air and where the air drawn from the BSC work area goes.

### Class II, Type B2 BSC – How it works

For a B2 BSC, the air is pulled in at the front aperture creating an air barrier that gives the operator protection. Air is also pulled from an opening at the top of the cabinet that supplies the downflow fans with air (Figure 2). Then the air goes through a HEPA filter and is 100% exhausted through a dedicated duct with an exhaust fan motor. The air is then released into the atmosphere. The purpose of this is to remove toxic vapors that

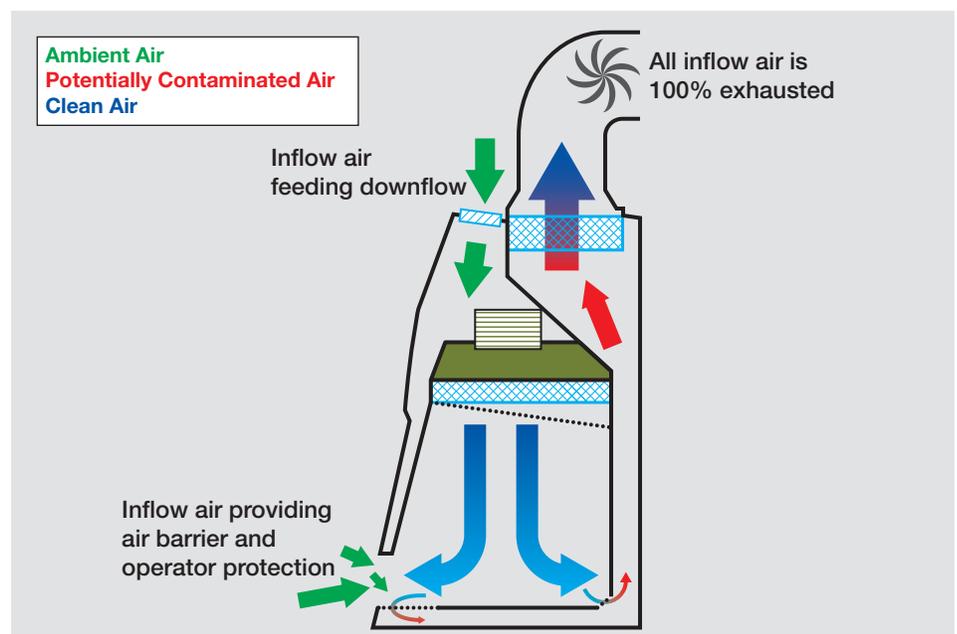


Figure 2. Demonstration on how a Thermo Scientific™ Class II, Type B2 BSC operates.

are generated in the cabinet with no recirculation within the BSC.

Airflow through a B2 is 100% externally exhausted which means the air that is drawn into the cabinet is 100% exhausted into the atmosphere. None of the air drawn into the B2 for either inflow or downflow is recycled within the airflow system. This is where an A2 differs as it does recycle a portion of its air after filtration – approximately 60% to 70%.

### Class II, Type A2 BSC – How it works

In a Class II, Type A2 BSC air is drawn in through the front aperture, which provides operator protection (Figure 3). The inflow air mixes with the downflow air as it enters the front intake grille and then passes through the plenum where the air splits. Approximately 60% to 70% of the air is recycled and pushed back into the BSC work area through the downflow

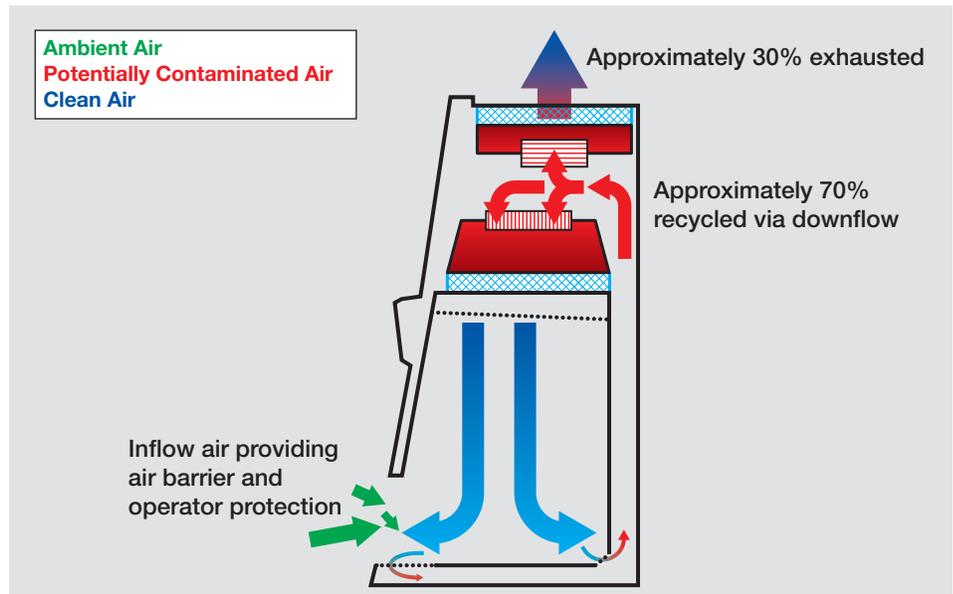


Figure 3. Demonstration on how a Thermo Scientific Class II, Type A2 BSC operates.

HEPA filter, and the remaining 30% to 40% is exhausted through the exhaust HEPA filter. This filtered exhaust air can be externally extracted with a thimble system, direct duct or simply extracted back into the laboratory. However, if volatile chemicals are used within the BSC as an adjunct to

microbiological work, exhaust must be released into the atmosphere through a thimble system or direct duct.

Alternatively, in Europe, if small amounts of chemicals are used in a recirculating BSC and if approved by safety personnel, a carbon filter may

Comparison between Class II, Type B2 and Class II, Type A2 BSC		
Characteristic	Class II, Type B2 BSC	Class II, Type A2 BSC
Airflow pattern	No recirculation within work area. 100% total flow is exhausted.	Approximately 70% of air is recycled and approx 30% exhausted
Exhaust system type	Must be direct ducted as per NSF	Can have three types of exhaust: <ol style="list-style-type: none"> <li>1. Recirculating — filtered exhaust into room</li> <li>2. Thimble-type duct</li> <li>3. Direct duct (only EN12469, NSF 49 does not allow direct duct for A2 type BSC)</li> </ol>
Inflow velocity	≥100 FPM (NSF 49)	≥ 100 FPM (NSF 49) ≥ 0.40 m/s (EN12469)
Downflow velocity	Not defined	Not defined (NSF 49) 0.25–0.50 m/s (EN12469)
Recognized by EN12469	No	EN12469 only recognizes 1 type of Class II BSC, which is very similar in design to an NSF 49 A2 type BSC

be installed after or as a part of the exhaust HEPA filter.

**IMPORTANT NOTE:** NSF/ANSI 49 allows for an A2 BSC to be connected to a thimble (canopy) system but does not allow for them to be connected to a direct duct system. EN12469 allows both thimble and direct duct A2 BSCs.

### Comparing A2 and B2 BSCs

There is a misconception that a B2 BSC is safer than an A2. They are both equally safe from a microbiological perspective and provide operator and product protection.

A B2 BSC may provide additional protection for the user when working with vapors and gases where aseptic conditions are required. The B2 provides greater dilution of any volatile chemicals within the BSC work area and eliminates even the diluted recirculation of volatile chemicals being used in the BSC. B2 cabinets are designed for work that involves volatile, toxic chemicals or radionuclides. This is in addition to the microbiological work being completed.

When an A2 BSC is connected to a thimble (canopy) system or direct duct exhaust system, it too can be used with volatile chemicals or radionuclides.

Although larger quantities of volatile chemicals and/or radionuclides may be used in a B2 BSC, given the greater dilution capability, restrictions will still apply. Flammable corrosive or explosive materials should not be used in either A2 or B2 BSC, and the user may need to consider using a traditional fume cupboard for these types of applications.

### Considerations

There are a number of important points to consider before deciding which type of BSC is right for your application. One of the biggest and often overlooked is the total cost of ownership for a BSC.

The overall start up cost and lifetime cost of a B2 is far greater than an A2 cabinet. A B2 will have:

- Higher start up cost
  - Higher rated external exhaust fan
  - Dedicated ductwork
  - Installation

- Approximately 2.5 times more air exhausted than an A2 cabinet
- More conditioned supply of air required to replace a greater volume of exhausted air
- Higher energy consumption
- Larger carbon footprint
- Higher energy bills
- Higher total cost of ownership

Another point to consider before purchasing a B2 over an A2 BSC is the effect on the materials within the BSC. For example, if you use a relatively large amount of chemicals that pass through the BSC, the HEPA filter could be impacted. HEPA filters are made from one piece of continuous paper like media and a glue-like substance. Chemicals pose a risk to delicate HEPA filters. Some of the interior surfaces of the B2 BSC may also be susceptible to chemical use.

### Comparison of air volumes

Below is a schematic showing the airflow pattern and air volumes exhausted from an A2 thimble and B2 BSC (Figure 4).

The B2 is exhausting more than twice the amount of air directly out of the laboratory than the A2. The A2 is exhausting 358 CFM with 30% additional air from the room for the thimble and the B2 is exhausting 734 CFM. The large amount of air that a B2 requires is often overlooked. Also note the greater negative static pressure required by the B2. For the B2, the external extract system must draw this larger exhaust volume with no assistance from the cabinet while the filtered exhaust from the A2 BSC

### What Class II, Type A2 and Type B2 BSCs provide

- Use HEPA filter technology
- Contain and protect the user from biological agents
- Protect the environment
- Protect the samples inside the work area
- Provide unidirectional (laminar) downflow
- Can be used for Biosafety Levels 1, 2, 3
- Thimble or direct ducted A2 and B2 can be used with volatile toxic chemicals required as an adjunct to microbiological work

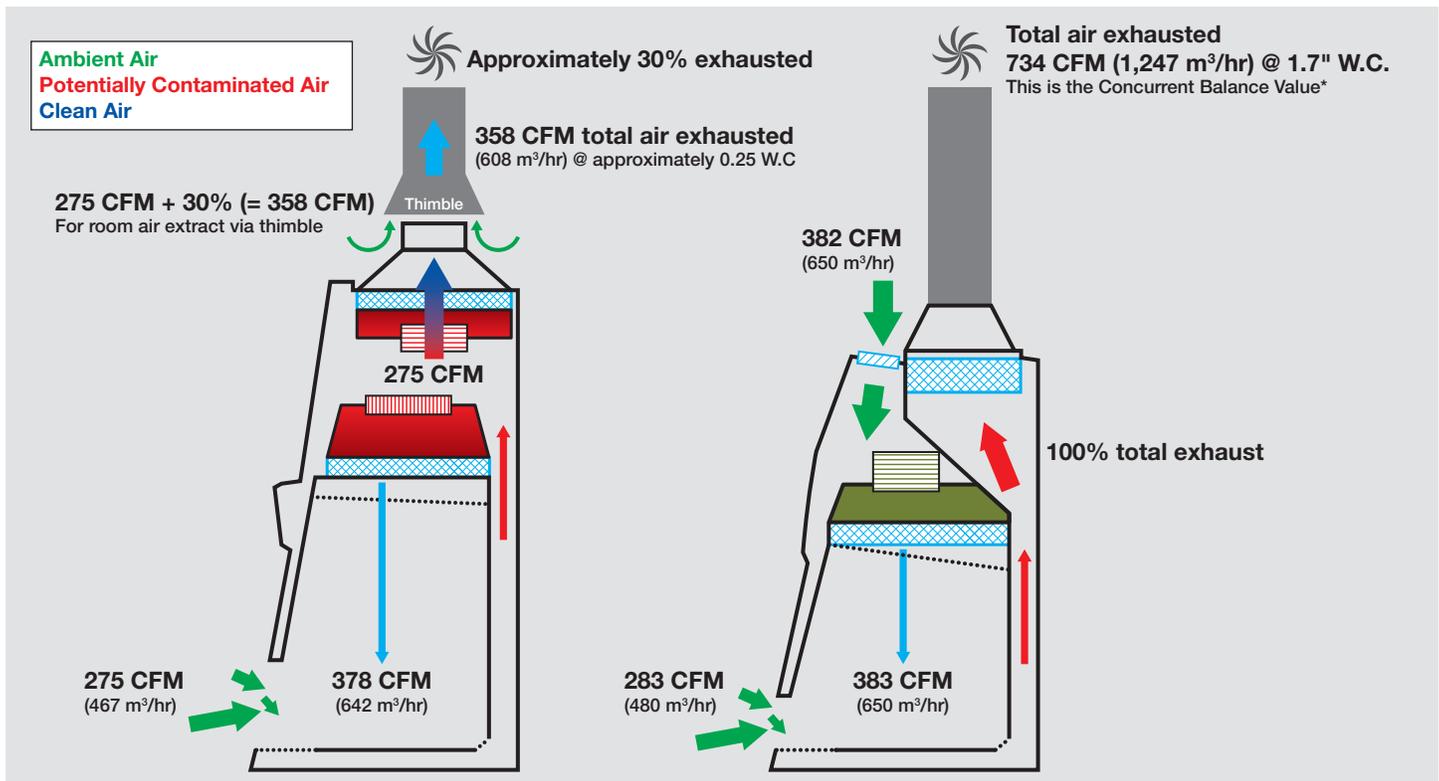


Figure 4. Thermo Scientific Type A2 BSC (thimble) and Thermo Scientific Type B2 BSC.

is pushed out the exhaust filter by the cabinet. In Figure 4 we see that while the A2 BSC requires up to 358 CFM exhaust at 0.25 inches w.c. negative static pressure, the B2 BSC requires 734 CFM at 1.7 inches negative static pressure. Not only does a B2 BSC require more exhaust volume, the extract system must work harder to draw this larger amount of air.

The A2 thimble type in this example is operating at an additional 30%. Manufacturers would normally recommend a thimble operates 5–30% above the cabinets exhaust volume. As a result, potentially the air volume of the A2 thimble could be even lower.

This difference in exhaust air has a direct affect on room pressures,

supply air and extract air volume, and a much larger rated external exhaust fan will be required for the B2 BSC.

### What is concurrent balance value for Type B2 BSCs?

The Concurrent Balance Value (CBV) was implemented by the NSF Joint Committee members to minimize confusion as to the exhaust airflow requirements of direct connected types such as the B2 BSC. There was variability in air volume measurements between field certifiers and HVAC designers.

**NSF DEFINITION:** This value is determined using the duct traverse measurement method as specified in ASHRAE 111-2008, a minimum of 7.5 duct diameters downstream of a direct connected BSC. Prior to determining

the concurrent balance value, it shall be confirmed that the cabinet is operating at its nominal setpoints for inflow and downflow velocity  $\pm 3$  fpm. The primary DIM method shall be used for setting the inflow velocity. The accuracy of the DIM shall be better than or equal to  $\pm 3\%$  and  $\pm 7$  CFM. The static pressure is also measured approximately two duct diameters from the cabinet exhaust connection. Appropriate filter load and tolerance values shall be added to the base static pressure value to accommodate filter loading: 0.3 in w.g. shall be added for Type B1 cabinets and 0.7 in w.g. shall be added for Type B2 cabinets.

The resulting values may be used for design and balance exhaust/supply HVAC requirements.

**AUTHORS NOTE:** Always use the CBV from the relevant manufacturer in planning the external exhaust system to meet the requirements of the B2 BSC.

## Summary

In most applications, a Class II, Type A2 BSC will be acceptable for your needs. Great consideration needs to be applied when specifying a Class II, Type B2 BSC. The substantial amount of air consumed by a B2 BSC is costly and must be replenished through the building's air handling units. It is important to remember that the air has already been conditioned before the B2 BSC draws it up discharging it into the atmosphere.

Finally, B2 BSCs must be ducted, and have an external fan. This adds additional costs, as well as lifetime costs such as power consumption.

Please contact your Thermo Fisher Scientific representative who can provide you with the understanding, technical expertise, and experience needed to help you choose which biological safety cabinet is required for your laboratory.

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# Thermo Scientific Biological Safety Cabinets New Lab Construction Glossary of Terms

**Access Opening (also called Front Access Opening or Sash Opening or Work Aperture):** The front opening of the chemical fume hood or Class II biological safety cabinet (BSC), through which work is performed. (adapted from SEFA 1-2006, Section 9.0)

**Activated Carbon Filter:** A filter that can trap trace amounts of chemicals and toxic odors.

**Aerosols:** Colloids of liquid or solid particles, less than 10 µm in diameter, suspended in gas.

**Aerosol Generator:** Electronic instrument used to generate an aerosol that is used to challenge HEPA filters for integrity.

**Aerosol Photometer:** Electronic instrument used to detect leaks on HEPA filter integrity testing. Used in conjunction with a generator.

**Air Changes per Hour (ACH or AC/H):** The number of times the air in a space (typically a room) is theoretically replaced during an hour. This is used as a measure of ventilation in a room. (adapted from SEFA 1-2006, Section 9.0)

**Airflow Velocity:** Measured in metres per second (m/s) or feet per second (f/s).

**Airflow Volume:** Measured in cubic metres per second (m<sup>3</sup>/s) or cubic feet per minute (ft<sup>3</sup>/min or cfm).

**Airflow Uniformity:** The required airflow pattern where all readings are within 20% of the average air velocity.

**Anemometer:** A measuring device used to measure air velocity.

**Aperture Protection Factor (APF):** A measurement of the containment safety of a Class II cabinet. This is done by using the KI-DISCUS test.

**Aseptic:** A sterile environment, free from contaminating particles or organisms.

**Bio-Hazard:** A contraction of biological hazard meaning a biological agent that is a threat to humans. (adapted from NSF/ANSI 49-2008, Section 3.2)

**Biological Safety Level (BSL):** There are four biosafety levels, BSL 1, 2, 3, or 4, consisting of combinations of laboratory practices and techniques, safety equipment and laboratory facilities. Each combination is specifically appropriate for the operations performed on the documented or suspected routes of transmission of the infectious agents and for the laboratory function or activity. BSL1 is appropriate for work with the least hazardous agents. BSL2 is typical of many biological laboratories including most hospital microbiological laboratories. BSL3 is used when more hazardous agents are handled. BSL4 is for work with the most dangerous agents.

**Biological Safety Cabinet (also called BSC or Biosafety Cabinet, formerly called Biohazard Cabinet):** A Class I, II, or III biological safety cabinet that provides personal or personnel protection AND environmental protection by HEPA filtration of the exhaust flow from the cabinet, which captures any biological hazards. The Class II and Class III BSCs also provide product protection through the provision of HEPA filtered clean air to the work area. The Class II BSC also provides protection from cross-contamination within the work area through the provision of laminar flow clean air flowing through the work area, which is not provided by all models of Class III BSC.

**Carcinogenic:** A cancer-causing substance.

**Certification (or Field Certification):** Documented test results showing performance and safety of a cabinet.

**Chemical Fume Hood (or Laboratory Hood):** A device located in a laboratory, enclosed on five sides with a movable sash or fixed partial enclosed on the remaining side. It is constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory. It also allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms. (adapted from OSHA's Occupational exposure to hazardous chemicals in laboratories 1910.1450 (b))

**Class I Biosafety Cabinet:** A ventilated cabinet for personnel and environmental protection, having an unrecirculated inward airflow away from the operator that exhausts all air to the atmosphere after filtration through a HEPA filter. Class I cabinets are suitable for work where no product protection is required. (adapted from NSF/ANSI 49-2008, Section 3.4.1)

**Class II Biosafety Cabinet:** A ventilated cabinet for personnel, product, and environmental protection having an open front with inward airflow for personnel protection, downward HEPA filtered laminar airflow for product protection, and HEPA filtered exhausted air for environmental protection. NOTE – When toxic chemicals or radionuclides are used as adjuncts to biological studies or pharmaceutical work, Class II cabinets designed and constructed for this purpose should be used. (adapted from NSF/ANSI 49-2008, Section 3.4.2)

**Class II, Type A1 BSC:** This is the first Class II BSC design. It only needs a minimum inflow of 75 fpm and until 2009 was allowed to have positive pressure contaminated plenums exposed to an outer wall.

**Class II, Type A2 BSC (formally Class II, Type A/B3 BSC):** The most common type of BSC. It is required to have a minimum inflow of 100 fpm and is not allowed to have positively pressurized contaminated plenums exposed to an outer wall of the cabinet. Most biological applications (like cell culture and biosafety) do not use volatile toxic chemicals or volatile radionuclides so an A2 vented to the laboratory is ideal. If volatile toxic chemicals or volatile radionuclides are used with the biological research, they can externally exhaust this cabinet through a thimble connection.

**Class II, Type B1 BSC:** The first externally exhausted or ducted Class II BSC design, which is not commonly used today. It has a minimum inflow of 100 fpm and no positively pressurized contaminated plenums. The recommended usage for volatile toxic chemicals is the same as for the thimble A2.

**Class II, Type B2 BSC (also called a Total Exhaust Hood):** The preferred type of Class II BSC by NIOSH (US) for work with anti-cancer (cytotoxic or hazardous) drugs. It has a minimum inflow of 100 fpm and no positively pressurized contaminated plenums. It has a large exhaust requirement as measured by flow (in cfm/cmh) and suction (in static pressure – inches w.g. or pascals). Its recommended usage for volatile toxic chemicals is the same as for the thimble A2.

**Class III Biosafety Cabinet:** A totally enclosed, ventilated cabinet of leak-tight construction. Operations in the cabinet are conducted through attached rubber gloves. The cabinet is maintained under negative air pressure of at least 0.50 in w. g. (120 Pa). Downflow air is drawn into the cabinet through HEPA filters. The exhaust air is treated by double HEPA filtration or by HEPA filtration and incineration. Insider note: A Class III BSC is a certain type of glovebox. So while all Class III BSCs are gloveboxes, not all gloveboxes are Class III BSCs. (adapted from NSF/ANSI 49-2008, Section 3.4.3)

**Cleanroom:** A room or suite of rooms with controlled limits set for air cleanliness/pressures/airflows/temperature/operating procedures.

**Concurrent Balance Value:** Field certifiers in North America use different methods to measure BSC exhaust than used by air balancers and the traditional HVAC engineers. The concurrent balance value is the exhaust flow measurement from the BSC (usually a Type B1 or B2) as if measured by the air balancer or HVAC engineer.

**Containment:** The use of HEPA filters to control airflow and pressure within a cabinet or other enclosure or room to capture hazardous aerosols.

**Containment Level 3 Laboratory (also called Physical Containment Level 3 Laboratory and in the UK a Cat III or Category III Laboratory):** As described in the European Standard EN 12128:1998 “Biotechnology – Laboratories for research development and analysis, containment levels of microbiology laboratories, areas of risk, localities and physical safety requirements.” This is generally analogous to the US or WHO BSL3 Laboratories. This document addresses the physical containment elements of the microbiology laboratory so it does not describe what classes of BSC should be present. EN 12128:1998 has the following requirements for Cat III laboratories (this is only a partial list):

- The exhaust (extract) air from the laboratory must be HEPA filtered.
- The laboratory can be sealed for disinfection (fumigation).
- The laboratory is negatively pressurized relative to outer areas.

**COSHH (also called Control of Substances Hazardous to Health Regulations 2002):** One of the key regulatory documents addressing biological safety provisions in the UK. Schedule 3 of this document is “Additional Provisions Relating to Work with Biological Agents”. Biological agents are classed into Group 1 through Group 4 analogous to the Risk Group system used by the WHO. Based on the Group of the biological agent, they are assigned to minimum containment levels. In Schedule 3 addressing containment in health and veterinary care facilities, laboratories and animal rooms, the document requires “Infected material, including any animal, is to be handled in a safety cabinet or isolator or other suitable containment” for Containment Levels 2 and 3 when aerosols are produced and in Containment Level 4 all the time.

**Contaminated Plenum (usually more correctly called Potentially Contaminated Plenum):** The space in which a gas, usually air, is contained at a pressure different from atmospheric pressure. This plenum contains potentially contaminated air as the air originated within the work area of a BSC and has not been filtered. (adapted from the “NIOSH Alert – Preventing Occupational Exposures to Antineoplastic and Other Hazardous Drugs in Health Care Settings – September 2004”)

**Cross Contamination:** Contamination from other products or processes at the same process time or during (from) earlier operations.

**Cytotoxic or Chemo:** Sometimes Class II BSCs are used for the preparation of antineoplastic drugs (chemotherapeutic agents that control or kill cancer cells) and some believe these dangerous chemicals can off-gas or vaporize and pass through HEPA filters. It is the recommendation of NIOSH that for the safe preparation of the drugs under aseptic (clean) conditions, one of the following ventilated cabinets must be used; Class II BSC (Type B2 is preferred, but Types A2 and B1 are allowed under certain conditions), Class III BSC, or aseptic containment isolators. In Europe, according to DIN12980 it is recommended to use a Triple Filter BSC with a single piece work-top, which is externally exhausted through a Thimble connection. (adapted from the “NIOSH Alert – Preventing Occupational Exposures to Antineoplastic and Other Hazardous Drugs in Health Care Settings – September 2004”)

**Damper:** A device installed in a duct to control airflow volume. For a BSC external exhaust, they may specify an “air-tight” or “gas-tight” damper so when the external exhaust duct is closed off with this damper, there will be no flow of air. Typically, this is done to seal the BSC for decontamination or fumigation. Some BSCs have an internal damper or choke to regulate the amount of air from the single BSC fan that goes to the exhaust filter rather than the downflow filter. (adapted from SEFA 1-2006, Section 9.0)

**Decibels:** Unit of sound measurement.

**Decontamination:** The destruction or removal of living organisms (this does not imply either total destruction or total removal). Also, the the removal or neutralization of toxic agents or chemical carcinogens. (adapted from OSHA’s Bloodborne Pathogen Standard – 29 CFR 1910.1030)

**DIM or Direct Inflow Measuring Device:** A volumetric airflow measuring device consisting of a capture hood with a sensing component that provides a readout as a single value for volumetric flow rate. (adapted from NSF/ANSI 49-2008, Section 3.12)

**Direct Connection (also called Hard Connection):** A BSC exhaust connection where the connection between the BSC and the external exhaust system is solid with no designed gaps or openings. The external exhaust draws air sufficient to capture all exhaust from the BSC and maintain a negative pressurization in the exhaust duct. The direct connection type of BSC exhaust connection is required for Class II, Type B1 or B2 BSCs.

**Diocetyl Phthalate (DOP):** Used as an aerosol to test for integrity of HEPA filters. Now PAO (poly alpha olefin) is often used but the use is identical. Sometimes the term “DOP test” is used to describe a HEPA filter leak test without intending to specify the use of DOP as the aerosol.

**Downflow Air (also called Supply Air):** Air that moves down through the BSC work area through a HEPA filter and protects the product.

**Duct:** Round, square or rectangular tube used to enclose moving air. (adapted from SEFA 1-2006, Section 9.0)

**EN 12469:** The mandatory European performance criteria for microbiological safety cabinets. It is the current and only CEN (European) norm standard for microbiological safety cabinets. This replaced ALL previous European standards (BS British, DIN Germany and CEN France). In the UK, it replaced parts 1 and 3 of BS 5726. Parts 2 and 4 were recommendations.

**Exhaust (also called Exhaust Flow):** The flow of air exiting or being exhausted from the BSC. For all Class II BSC except type B2s, the inflow equals the exhaust. For B2s, the exhaust flow or volume is equal to the downflow plus the inflow. This is usually expressed in cfm/cmh. Note, a room or building can also have “exhaust.”

**Exhaust Alarm:** The alarm on the BSC exhaust flow that will signal when the exhaust flow drops outside (usually below) acceptable quantities. For our purposes, there are two types of exhaust alarms. One is associated with the cabinet and will signal when the BSC exhaust is incorrect. For direct connected BSCs, like B1s or B2s, this is required by NSF and only one exhaust alarm is needed or required. For A2s without thimble connections (vented into the room), an exhaust alarm would signal when the cabinet blower was not delivering sufficient exhaust (which is the same as inflow). For A2s with a thimble connection (vented into an external exhaust system), an exhaust alarm would signal when the cabinet blower was not delivering sufficient exhaust or that the external exhaust system was not drawing enough for the thimble to allow the BSC to operate AND capture any exhaust coming from the BSC.

**Exhaust Connection (also called Exhaust Transition):** The physical component allowing the connection of the B1 or B2 BSC to external exhaust which is usually included with the BSC. For A2s, the thimble also serves as the exhaust transition.

**Exhaust (also called Extract):** Every Class II BSC has exhaust. If a thimble connected A2 or a B1 or B2 BSC is used, they require external exhaust. External exhaust is the building exhaust system including at a minimum an exhaust fan on the roof and exhaust duct connecting the roof exhaust fan to the BSC exhaust connection.

**Grade A, B, C, and D Cleanroom Classification:** The European system established in “Volume 4 - EU Guidelines to Good Manufacturing Practice, Medicinal Products for Human and Veterinary Use, Annex 1 - Manufacture of Sterile Medicinal Products” (corrected version). Often this is just referred to as Annex 1. Grade A is the local zone for the point at which the product is most at risk of contamination; often a laminar airflow system (BSC, clean bench, isolator, etc.) is the Grade A area. Grade B is the room that the Grade A device or area is surrounded by for aseptic preparation and filling. Grades C and D are for clean areas with less critical stages of pharmaceutical manufacturing.

16.6 **Grade A Cleanroom Classification:** Generally, Grade A areas or equipment provide ISO Class 5 air cleanliness at rest and in operation except a little cleaner for the 5.0 micrometer and larger particle size with 20 particles allowed per cubic meter instead of 29.

**Grade B Cleanroom Classification:** Grade B areas provide ISO Class 5 air cleanliness at rest for both 0.5 and 5.0 micrometer and larger particles and ISO Class 7 air cleanliness in operation except a little cleaner for the 5.0 micrometer particle size with 2,900 particles allowed per cubic meter instead of 2,930.

**Grade C Cleanroom Classification:** Grade C areas provide ISO Class 7 air cleanliness at rest except a little cleaner for the 5.0 micrometer particle size with 2,900 particles allowed per cubic meter instead of 2,930 and ISO Class 8 air cleanliness in operation except a little cleaner for the 5.0 micrometer particle size with 29,000 particles allowed per cubic meter instead of 29,300.

**Grade D Cleanroom Classification:** Grade D areas provide ISO Class 8 air cleanliness at rest except a little cleaner for the 5.0 micrometer particle size with 29,000 particles allowed per cubic meter instead of 29,300, and the requirements are not specified for in operation.

**HEPA Filter:** A high efficiency particulate air filter.

**HPA:** Health Protection Agency based in Porton Down is a special health authority and has become the UK’s leading independent type test authority for clean air and containment equipment. Its primary role is “to protect the community (or any part of the community) against infectious diseases and other dangers to health” (HPA Act 2004). HPA will test and validate Class II cabinets to determine whether they meet the requirements of the European Standard EN12469. HPA does not provide any indication of validation of the cabinet design on the cabinet as provided by LNE or TUV.

**Hood:** Class II BSC or Class I BSC, but usually not a Class III BSC. Could also be a fume hood or a no-flow static containment hood.

**Face Velocity:** Inward airflow velocity at the cabinet opening.

**KI-DISCUSS Test:** A fine mist of potassium iodide droplets, produced by a spinning disk, is used as a challenge aerosol to measure the containment of a cabinet or fume cupboard. Centripetal collectors sample the air outside or inside the cabinet – depending on the nature of the test. The collectors deposit any potassium iodide particles that are in the sampled air on to filter membranes. At the end of the sampling period the filter membranes are placed into a solution of palladium chloride whereupon the potassium iodide “develops” to form clearly visible and easily identified grey/brown dots.

Knowledge of the number of droplets in the challenge produced by the mist generator and the number collected in the air samplers enables the protection factor for the cabinet to be calculated. All open-fronted microbiological safety cabinets can be assessed on this protection factor. (adapted from <http://www.kidiscus.com>)

**Laminar Air Flow:** HEPA-filtered air stream moving within a confined space at uniform velocity, moving along parallel flow lines. Actual correct term should be “unidirectional air flow.” See Unidirectional Air Flow.

**Laminar Air Flow Cabinets (also called Horizontal Flow Cabinets or Clean Air Benches):** Self-contained laminar work flow stations providing unidirectional airflow and sterile work areas. Used for non-hazardous material. NOT to be used with biological hazard work.

**Laboratoire National d’Essais (LNE):** Established in 1901 as part of the Conservatoire National des Arts et Métiers (CNAM), France’s most recognized certification institute. It was set up to meet industrial testing and measurement requirements, especially in the fields of materials, machinery and physics. LNE will test and validate Class II cabinets to determine whether they meet the requirements of the European Standard EN12469. Successful validation of the cabinet model by LNE is demonstrated by an NF sticker on the cabinet.

**Micron (also called Micrometer):** A unit of measurement equal to one-millionth of a metre. Expressed as  $\mu\text{m}$ .

**Negative Pressure:** Air flows from positively pressurized areas into negatively pressurized areas. Negative pressure in a space would cause an inflow of air.

**NSF:** The NSF certification program is accredited by the American National Standards Institute (ANSI) and the standards council of Canada. It is the leader in validation of Class II cabinets throughout the USA. NSF International tests and validates Class II cabinets to determine whether they meet the requirements of NSF/ANSI 49. Successful validation of the cabinet model by NSF is demonstrated by a NSF sticker on the cabinet.

**NSF Listing:** A Class II BSC is “NSF listed” when NSF has tested the model to verify it meets the materials, design, construction, and performance requirements of NSF/ANSI 49. If a cabinet is NSF listed, it can have the blue NSF sticker. Some cabinets may claim it meets the requirements of NSF/ANSI 49, but it may not have been tested and officially listed. NSF sends the engineering team a final copy of the confidential test report. The NSF website ([www.nsf.org/Certified/Biosafety/](http://www.nsf.org/Certified/Biosafety/)) lists the BSCs that have passed their independent testing, and this public posting is what is available to customers as proof of certification pre-sale.

**Particle Counter:** Electronic instrument used to count the numbers and sizes of airborne particles and determine cleanliness of environment.

**Plenum:** An enclosure for flowing gases in which the static pressure at all points is relatively uniform.

**Positive Pressure:** Air flows from positively pressurized areas into negatively pressurized areas. Positive pressure in a space would cause an outflow of air.

**Safe Change System:** A system which enables filters or filter systems to be changed without hazard to the operator and the back ground environment.

**Sterile Air:** Air filtered to exclude particles, including microbiological life (e.g. bacteria, viruses).

**Supply Air (also called Downflow Air):** Downflow air entering the cabinet work area through the downflow filter and diffuser. In Class II cabinets, this air passes through the supply HEPA filter before moving vertically down to the work surface.

**Thimble:** A BSC exhaust connection where there are one or more openings or gaps in the connection between the BSC and the external exhaust system. The external exhaust draws air sufficient to capture all exhaust from the BSC and to maintain a flow of air into the exhaust connection through the openings or gaps. The flow of air through the openings or gaps provides a buffer between the BSC exhaust and variation in the external exhaust system assuring consistent BSC performance, odor control and/or containment of volatile toxic chemicals, and tracer amounts of radionuclides used in the BSC. The canopy connection type of BSC exhaust connection is required for externally vented Class II, Type A1 or A2 BSCs.

**ULPA (Ultra Low Particulate Air) Filter:** Provides a higher level of filtration than a HEPA filter. There has been some confusion about whether the European classed H14 filter is actually an ULPA filter. The European Standard EN 1822 states the H14 is a “HEPA” (the “H” in H14 stands for HEPA) and the next level filter, U15, is an ULPA (the “U” in U15 stand for Ultra).

**Unidirectional Airflow:** Where the plane of the air supplied from the HEPA filter is moving in one direction. Although the air velocities within the plane of movement may vary slightly, this term was previously referred to as laminar airflow.

**TUV:** Technischer Überwachungsverein or Technical Monitoring Association. The German certification board is widely accepted as the most stringent and comprehensive test a safety cabinet can undergo. Periodic retesting is required to comply with TÜV. TÜV will test and validate Class II cabinets to determine whether they meet the requirements of the European Standard EN12469. Successful validation of the cabinet model by TUV is demonstrated by a GS sticker on the cabinet.

**Ultra Violent Radiation (UV):** Ultra Violet Radiation. Used for disinfection in biosafety cabinet work area.

**Validation:** A set of procedures to create documented evidence that something meets design, construction, and performance specification.

**Work Area:** The area within the BSC intended for the user’s work. It extends from the inside edge of the front grill to the front edge of the rear grill, from the bottom side of the diffuser to the top side of the work surface and within the interior walls of the BSC. This is sometimes called the sample chamber. Certifier’s consider the work area the plane at sash level for BSCs NSF listed before 2002 and 4 inches above the sash for BSCs NSF listed after used for the measurement of downflow velocities for certification.

**Work Surface:** The stainless steel platform within the BSC intended for the user’s work. It extends from the inside edge of the front grill to the front edge of the rear grill and within the interior walls of the BSC.

[thermoscientific.com/bscnewlab](http://thermoscientific.com/bscnewlab)

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