

HERAsafe KS/KSP

Classe II Biological Safety Cabinets

Operating instructions

50077493 E

11/5/09



Dear User,

Congratulations on your purchase of a Thermo Scientific Herasafe KS and KSP Class II, biological safety cabinet! Your Herasafe KS biological safety cabinet has been tested and certified in accordance to NSF/ANSI 49 for Class II, Type A2 conditions, and is designed to protect the user, the environment, and your research from harmful substances and cross-contamination. The Herasafe KSP biological safety cabinet has been designed in accordance to EN12469 (Class II biological safety cabinetry, European harmonized standard) and DIN12980 ("Safety Cabinets for Handling Cytotoxic Substances", German standard).

This user's manual provides instructions on how to use the Herasafe KS and KSP most effectively and safely.

Containment * Comfort * Convenience™

The Herasafe KS and KSP offers a unique range of product features that will enhance your safety and improve overall operating efficiency. Should you have any questions on using this product or need further explanation of any of its features, please contact Technical Services (Page iv), or your local distributor.

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General Notes

The following are the addresses of the international Thermo Sales Organisations.

Postal address U.S.A.

Thermo Fisher Scientific Inc.
Controlled Environment Equipment
401 Millcreek Road, Box 649
Marietta, OH 45750

Inquiries from U.S.A. and Canada

Phone 1-866-984-3766
Fax 1-740-373-4189
E-Mail service.led.marietta@thermofisher.com

International inquiries

Phone 1-740-373-4763
Fax 1-740-373-4189
E-Mail service.led.marietta@thermofisher.com

General safety instructions

These safety instructions describe the safety features of the Herasafe KS and KSP series. The 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:

- The safety cabinet must be operated only by trained and authorized personnel.
- For any operation of this unit, 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.
- 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 unit 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.

Warranty

Thermo Fisher Scientific warrants the operational safety and functions of the 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.

Explanation of symbols

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.

Symbols on the device



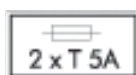
Observe operating instructions (cover electrical box)



Observe operating instructions (cover electrical box)



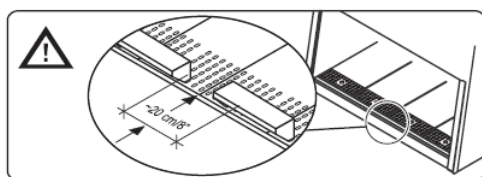
Hazardous Drugs (left device front)



T5A note (sample chamber fusing, type A2, in accordance with NSF/ANSI, Standard 49/2007)



RS 232 interface (connection label)



Armrest installation
(right side of light dome)



Checked safety, according to the EU General Product Safety Regulation



NSF compliant



ETL compliant

Use of the device

Correct use

Model Herasafe KS:

The safety cabinet is a laboratory device for installation and operation in biological and biomedical laboratories of biosafety levels 1, 2, and 3, and biosafety level 4 suit laboratories as described in Biosafety in Microbiological and Biomedical Laboratories. (The reference is Department of Health and Human Services, National Institute of Health, 6705 Rockledge Drive, Suite 750, MSC 7985, Bethesda, MD 20892-7985 www.nih.gov). It has been designed as a Class II biological safety cabinet type A2, in accordance with NSF/ANSI, Standard 49/2009.

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.

Model Herasafe KSP:

This variation of the Herasafe meets EN 12469 (the European Standard for microbiological safety cabinets) as certified by TUV-Nord and DIN 12980 / 2005-06 and per European recommendations can be used for the production of cytostatic agents.

For cytostatic agent applications, use the lowered one-piece working plate only.

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 or 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.

Incorrect use:

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

The unit must not be operated as a Class II biological safety cabinet type A2, 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 unit must only be released for operation if all alarm system components are functioning again properly.

The filters installed in the device are not capable of separating gaseous substances. Therefore, unless externally exhausted through a properly functioning thimble connection and approved by the appropriate safety officer, do not work with or store 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.

Standards and safety regulations

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

USA/Canada

- IEC 61010-1 / UL 61010A-1
- NSF/ANSI Standard 49/2009

Europe / Middle East / Africa

- IEC 61010-1 / EN 61010-1
- EN 12469 / 2000
- DIN 12980 / 2005-06
- Low Voltage Directive
- EMC Directive

Australia /Asia / Pacific

- IEC 61010-1
- AS 2252.2

Safety Precautions



WARNING The biological safety cabinet should be certified by a certification technician before its initial use. The cabinet should be recertified whenever it is relocated, serviced or at least annually thereafter. Do not assume that filter integrity and airflow performance have not been compromised during shipment.

Some internal components of the biological safety cabinet may become contaminated during operation of the unit. Only experienced personnel competent in decontamination procedures should decontaminate the cabinet before servicing these components. If you have any questions regarding certification agencies, or need assistance in locating one, contact Thermo Fisher Scientific.

Ensure that the cabinet is connected to electrical service in accordance with local and national electrical codes. Failure to do so may create a fire or electrical hazard. Do not remove or service any electrical components without first disconnecting the biological safety cabinet from electrical service.

Avoid the use of flammable gases or solvents in the biological safety cabinet. Care must be taken to ensure against the concentration of flammable or explosive gases or vapors. An open flame should NOT be used in the biological safety cabinet. Open flames disrupt airflow patterns in the cabinet and may burn the HEPA filter and/or damage the filter's adhesive. Gases under high pressure should not be used in the biological safety cabinet, as they may disrupt its airflow patterns.

HEPA filters only remove particulate matter. Operations generating volatile toxic chemicals or radionuclides must be evaluated carefully and when approved by an appropriate safety officer may require connection to a dedicated external exhaust through a thimble connection.

The media of HEPA filters is fragile and should not be touched. Avoid puncturing either HEPA filter during installation or normal operation. If you suspect that a HEPA filter has been damaged, DO NOT use the cabinet; contact a local certification provider.

The HEPA filters in the biological safety cabinet will gradually accumulate airborne particulate matter from the room and from work performed in the cabinet. The rate of accumulation will depend upon the cleanliness of the room air, the operating time and the nature of work being done in the cabinet. The Performance Indicator Factor accurately displays the amount of filter life remaining.

Proper operation of the cabinet depends largely upon its location and the operator's work habits. Consult the Installation and Normal Operation sections of this manual for further details.

Customer materials which are not UV-resistant should not be used during UV-disinfection inside the work chamber.

Never bypass the UV safety interlock that only allows the UV light to work when the sash is closed.

Delivery

Standard components

Delivery for the safety cabinet includes the following:

Model Herasafe KS:

- safety cabinet
- drain valve
- hand held control
- armrest

Model Herasafe KSP:

- safety cabinet
- armrests
- hand held control
- with filter housing and filters

All models:

- Device documentation:
 - operating instructions,
 - factory test report.

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

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.

Transport lock and device packaging

Do not transport the device over large distances without transport lock and original device packaging.

Delivery

Transport lock and device packaging

Installation

Ambient conditions

The operational safety and correct function of the unit depend on the location where it is to be operated. The 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 6500 ft (2000 m) above sea level.
- The mains power supply outlets should be out of normal reach to prevent accidental shut-off. Ideally, the outlets should be installed above the safety cabinet.
- The flooring of the location must be adequately strong and not flammable.
- The room in which the device is installed must be of adequate height. For units not connected to an exhaust system, the distance between the exhaust air opening and the room ceiling must be at least 8 in (200 mm).
- The location must be equipped with an appropriate ventilation system (see Section “[Room ventilation](#)” on [page 3-1](#)).
- The temperature within the room must be between 49 °F and 104 °F (15 °C and 40 °C).
- 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 -4 °F and +140 °F (-20 °C and +60 °C) at a relative air humidity of up to 90%. For longer storage periods, the location requirements apply.

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.

Correct location

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

Fig. 3-1: This figure shows preferred locations for biological safety cabinets and unsuitable locations, 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 undesirable because it is in 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.

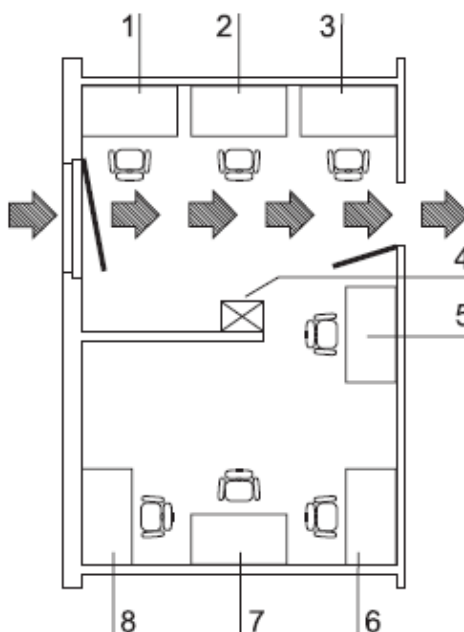


Figure 3-1 Locations in a room

Installation in line

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

- Make sure that vibrations cannot be transferred between adjacent units.
- Exterior surfaces of the biological safety cabinets must always be accessible for cleaning and disinfection. Give 10 inch (254 mm) clearance between the cabinets or side proximity.

Exhaust System

Connections

The Herasafe KS can be either recirculated to the room or exhaust through a canopy/thimble. NSF/ANSI 49 recommends a canopy connection for a Class II, Type A2 BSC when using minute amounts of volatile toxic chemicals and trace amounts of radionuclides. The external exhaust the thimble is connected to should have an exhaust alarm (see Options and Accessories)

If your research involves the use of toxic compounds or volatile materials, contact your facility's safety officer or Thermo Fisher Scientific to ensure that your cabinet and its exhaust system are compatible with the materials you will be working with.

Requirements

The cabinet exhaust stack is sized to accept 8 inch (200 mm) ductwork. The exhaust system's blower should be sized to handle the exhaust volume of each cabinet, as shown in the QuickCharts, Appendix E.

Note The exhaust system should be fitted with a backdraft damper to prevent the reversing of airflow in the system.

Transport

Model Herasafe KS:

Fig. 3-2: To prevent tilting, always transport the device using a suitable carrier, even for a transport within a building, and separate it from the stand.

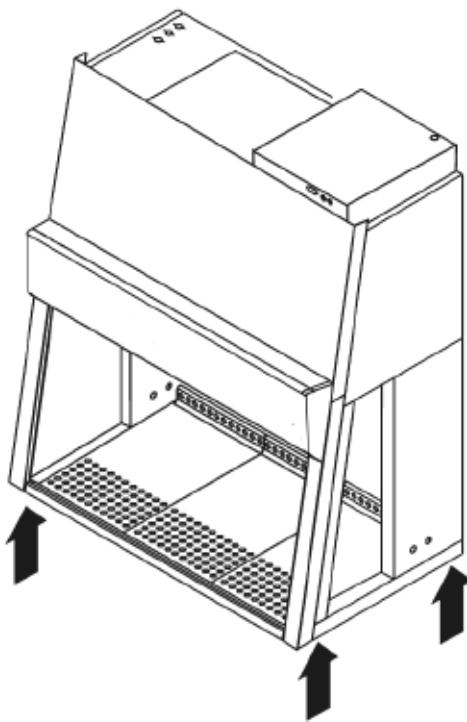


Figure 3-2 Lift points



CAUTION Danger of tipping over

For transport, lift the device only using the lift points shown in the illustration. Do not load the floorpan with the weight of the device frame!



CAUTION Contusion hazard

When lifting the safety cabinet, do not put hands or fingers between floorpan and frame!

Model Herasafe KSP:

If required, the device stand must be removed from the stand to be reinstalled onto the stand for the initial start-up after the transport (see Section “[Installing unit and accessories](#)” on [page 5-1](#)).

Installation Tests



WARNING Do not operate the unit before initial operation, installation and certification tests have been performed.

The installation test must be performed in accordance with the specifications of NSF/ANSI 49, 2009. The cabinet may be operated as a Class II biological safety cabinet, in accordance with NSF/ANSI 49 2009, if the unit functions listed below for a Class II, Type A2 biological safety cabinet were verified and if the test results are within the safety value tolerances as specified in NSF/ANSI 49 2009, Annex F.

- Inflow velocity profile test
- Downflow velocity profile test
- HEPA filter leakage test
- Airflow smoke pattern test
- Site installation assessment tests
- A repeat test must also be performed annually, after repairs to the unit or after relocation.
- The operator should request a written test report from the authorized service technician.



WARNING The operational safety of the unit, particularly the personal and product protection, are ensured only if all safety functions of the unit have been tested and approved.



CAUTION Fisher Scientific will not warrant operational safety if the unit is operated without the required installation and certification test, or if these tests and repeat test are not performed by adequately trained and authorized personnel.



CAUTION The initial operation with subsequent installation test does not include any decontamination measures. The sample chamber and any accessories required should be disinfected and cleaned in accordance with the hygiene guidelines set forth for the desired application.

Certification

Initial Certification

Prior to use, a qualified certifier should certify all biological safety cabinets. Under normal operating conditions, the biological safety cabinets should be recertified at least annually and when relocated or serviced. The certifier should perform the following tests for Class II, Type A2 biological safety cabinets, as recommended in ANSI/NSF International Standard Number 49 in effect when the cabinet was manufactured:

- Downflow Velocity Profile Test
- Inflow Velocity Test
- Airflow Smoke Patterns
- HEPA Filter Leak Test
- Site installation assessment tests

Locating a Certifier



CAUTION Service and certification must be performed by qualified personnel.

Biological safety cabinet certification consists of a series of tests designed to verify that the cabinet is performing within operating parameters established by the manufacturer. To assure that a biological safety cabinet is operating as intended, each cabinet should be field-tested at the time of installation and at least annually thereafter. Biological safety cabinets should be re-certified whenever HEPA filters are changed, internal maintenance is performed, or the unit is relocated.

Three industry-related organizations maintain lists of companies and individuals who are active in the certification industry. You may contact these organizations at the addresses listed below.

NSF International (NSF) and International Air Filtration Certifiers Association (IAFCA) sponsor certifier accreditation programs. Accredited certifiers have demonstrated proficiency at testing biological safety cabinets by successfully completing written and/or practical examinations.

Biosafety Cabinet Field Certifier Program
NSF International
PO Box 130140
789 N. Dixboro Rd
Ann Arbor, MI 48113-0140
Telephone (734) 769-8010 Or (800) NSF-MARK
Fax (734) 769-0109
<http://www.nsf.org/Certified/Biosafety-Certifier>

IAFCA
1171 Chesapeake Ave
Columbus, OH 43212
Telephone (888) 679-1904
Fax (614) 486-1108
<http://www.iafca.com/find.html>

The Controlled Environment Testing Association (CETA) is a trade association devoted to promoting and developing quality assurance within the controlled environment testing industry. A list of active members is available by contacting the organization.

Controlled Environment Testing Association
1500 Sunday Drive
Suite 102
Raleigh, NC 27607
Telephone (919) 861-5576
Fax (919) 787-4916
<http://cetainternational.org/content/member-directory>

Note Unless certification was expressly called for in the specification, quotes and/or purchase order, the cost for this on-site testing is to be paid for by the customer.

Unit description

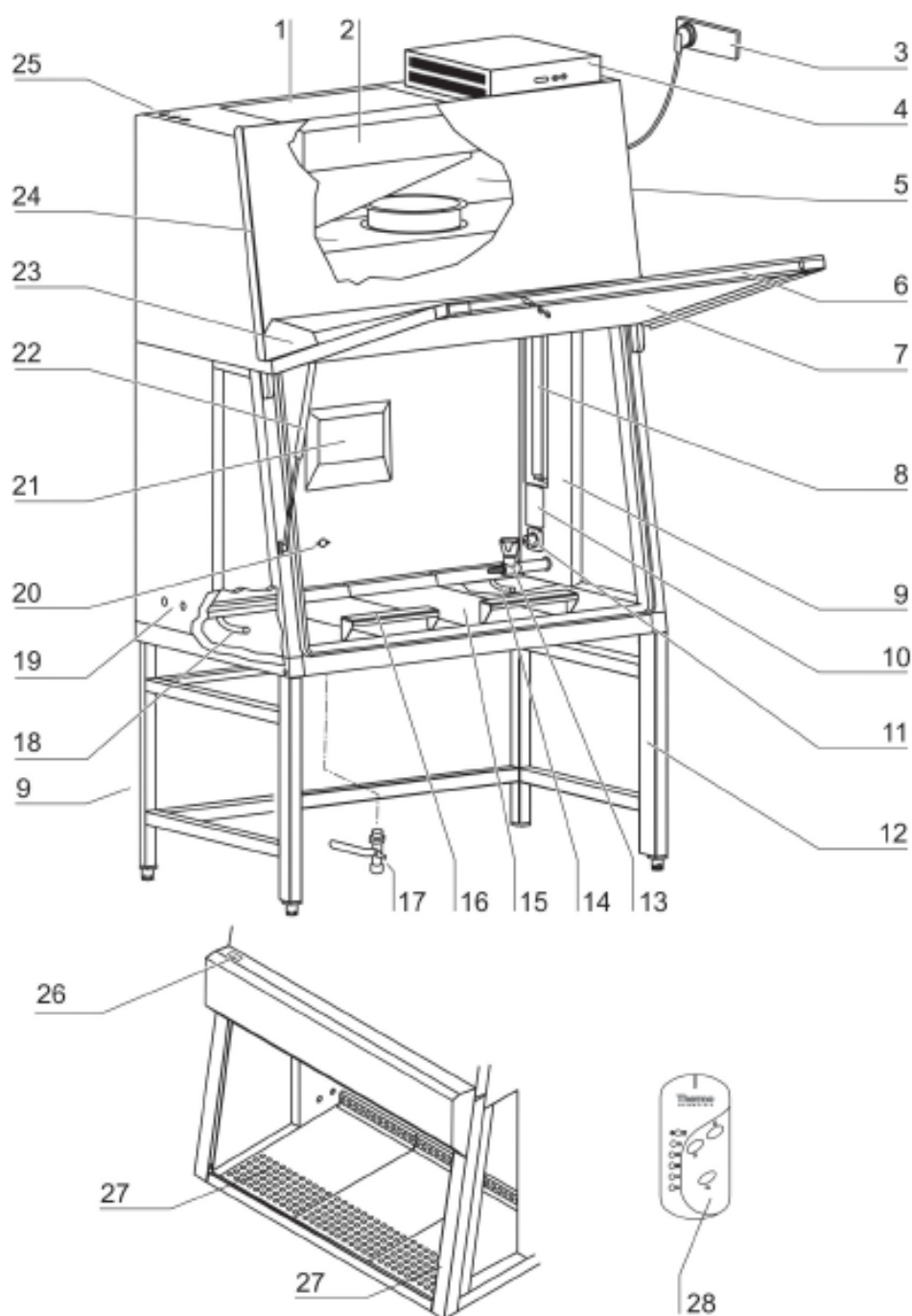


Figure 4-1 Overall view / Model Herasafe KS

Overall view

Model Herasafe KS:

- **Fig. 4-1:** Plenum assembly [5] with plenum for downflow blower [24] and plenum for exhaust air blower [2]. The downflow filter and the exhaust air filter are installed directly to the relevant blower. The exhaust air is released into the environment around the device through the opening [1].
- At the side of the plenum, the optional media supply lines [25] are routed into the sample chamber [20].
- Electrical box [4] with power supply cable [3]. An RS 232 connection to a PC and two fuse holders are installed at the front of the electrical box.
- Front cover [6] with integral, electrically movable front window [7], operated by:
 - the master switch [26].
The gas struts [22] secure the front cover in the open state.
Optionally, two safety latches [27] can be installed to the front cover so that the door can be protected against unauthorized opening.
- The light dome [23] with two tubes is part of the front cover assy.
- Side panels [9] with two sealed access openings [19]. These can be equipped with media valves [13].
- Internal outlets [10] for power supply of accessories and adapter [11] for mobile UV device.
- Optional UV lamp unit [8] consisting of two UV lamps per side.
- Optional stands [12], adjustable in height and with fixed height
- Workplate segments [15] with optional arm rests [16]. A one-piece workplate and special workplates are available options.
- Lockable drain valve [17] for installation into floorpan.
- Display [21] with alarm system indicators.
- Test hoses for the supply unit [18] at the left side of the sample chamber and for the exhaust unit [14] at the right side of the sample chamber.

Note Test hoses

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

Model Herasafe KSP:

- **Fig. 4-2:** Stand [5] with integral prefilter housing [6].
- Filter inserts [2] for the prefilter housing. The number of supplied filter inserts depends on the width of the device. To protect from liquid residues, the filter inserts are oriented slightly sloping from the device backpanel to form a drain duct to the floorpan [3].
The filter plates [4] have tongues and grooves and are inserted in an overlapping pattern from right to left.

- Membrane sleeve or opening for filling with aerosol for testing the filter of the downflow unit [1] at the left side of the sample chamber and of the exhaust air unit [7] at the right side of the sample chamber.

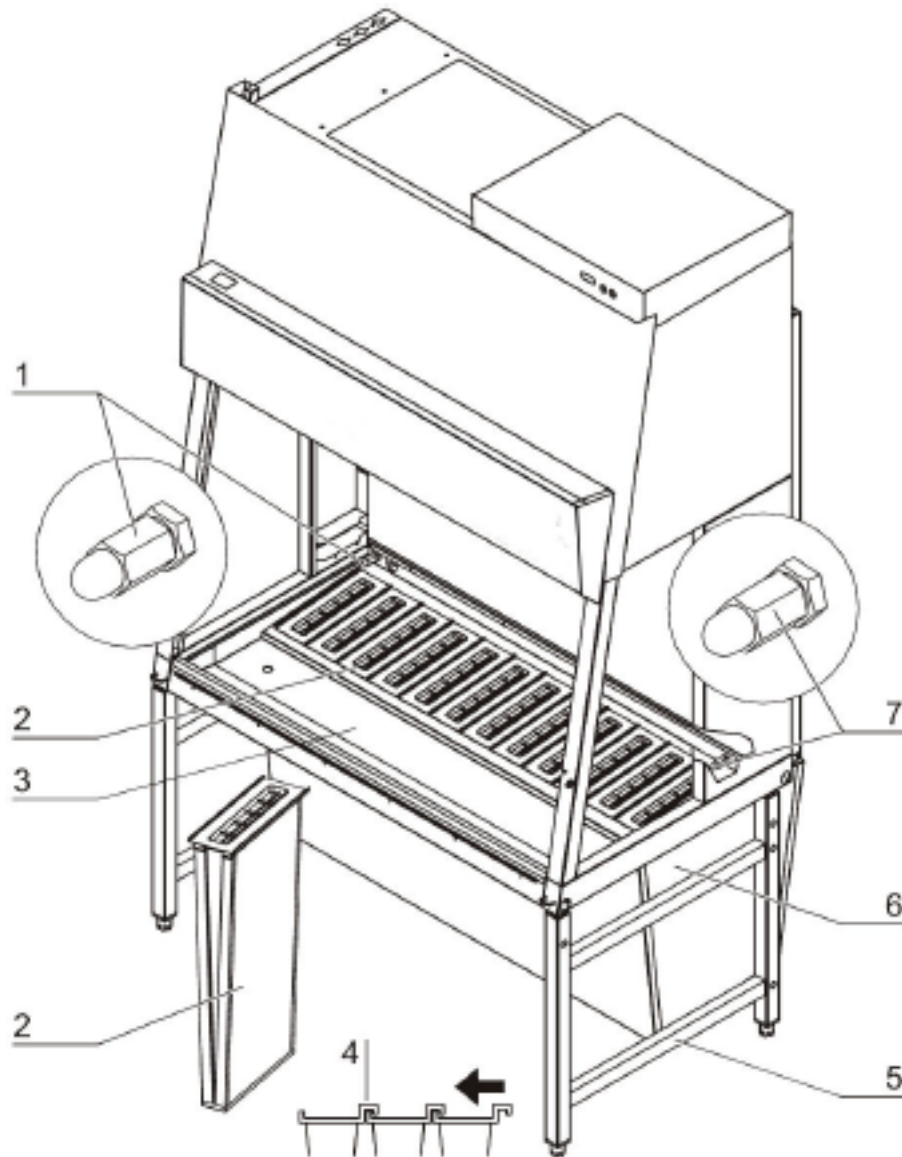


Figure 4-2 Overall view / Model Herasafe KSP

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/ULPA filters for downflow and exhaust air forms the basis of the safety system for personal and material protection.

- **Personal protection**

The Thermo Scientific Herasafe KS/KSP offers innovative SmartFlow™ technology; an automatic airflow compensation system that adjusts motor speed as filters load, without the use of a manual damper. The SmartFlow™ system ensures safe working conditions, even between annual certifications. The plenum assembly consists of a plenum for the downflow blower and a plenum for the exhaust air blower. Each blower includes a filter. The exhaust air is discharged through an opening in the top of the cabinet.

- **Material protection**

A steady airflow within the air system ensures that:

- a constant downflow allows 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) or ULPA filters (ULPA= Ultra Low Particle Air filter).

For version Herasafe KSP, a prefiltering system is used to increase the filter efficiency and to protect the exhaust air and downflow systems.

- **UV 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.

Warning systems:

- **Digital Airflow Verification (DAVe)**

Independent monitoring of inflow and downflow air velocities guarantees that product and personal protection remain uncompromised. Airflow monitoring determines the velocity of the airflow in the sample chamber as well as the inflow velocity of air through the exhaust opening. As soon as airflow velocities rise above or fall below a specified safety value, an audible and a visual alarm is activated.

- **Airflow monitoring**

Airflow monitoring determines the velocity of the airflow in the sample chamber as well as the inflow velocity of the air aspired 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 aspired from the exterior,
- downflow velocity,

- working 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.
- **Position monitoring**
The position sensors monitor the position of the front cover as well as the movement of the front window; it will indicate when the front window is in the working position.
- **Performance Factor**
The Performance Factor (PER) is a value that indicates the safety state of the safety cabinet. This value is calculated from data determined by the safety system and from values captured empirically by service personnel during safety checks. This data is entered into a parameter list of the control software and interconnected. The result can be indicated by the display.

Filter system

Model Herasafe KS:

Fig. 4-3: The filter system consists of two HEPA filters [2] and [5] (downflow and exhaust) for the circulating air and for the exhaust air.

HEPA filters: Room air [10] is drawn into the sample chamber through the working opening. In the air plenums under the work surface and behind the rear interior wall, the room air and downflow air from within the chamber [7] mix as they move to the motor plenum above the sample chamber (9).

From the motor plenum:

- some air is drawn into the downflow fan (4) and pushed through the downflow filter (5), entering the sample chamber as essentially particle free air (6).
- some air is drawn into the exhaust fan (3) and pushed through the exhaust filter (2), returning to the room or thimble external exhaust transition as essentially particle free air (1).

Inlet protective grille: Just prior to the air plenum behind the rear interior wall, a protective grille (8) is provided to capture large debris like pieces of paper before they can be drawn into the motor plenum and potentially impair blower functioning.

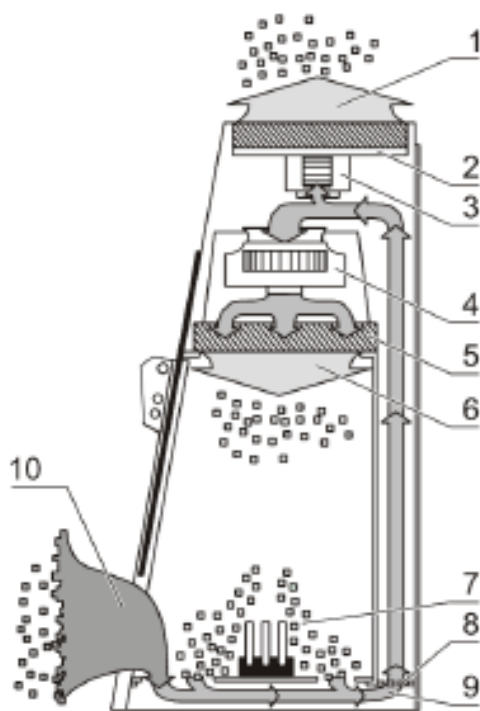


Figure 4-3 Filter system with downflow filter and exhaust air filter / model Herasafe KS

Model Herasafe KSP:

Fig. 4-4: The filter system consists of a set of HEPA primary filters (2) in an additional plenum below the work surface and two HEPA filters and for downflow air and exhaust air (5).

HEPA primary filter:

The compact size of the filter inserts allows filter replacement with minimal contamination hazard.

The use of the primary filter protects the downflow and exhaust air filters considerably.

The filter inserts used are HEPA filters of Class H14 (according to EN 1822).

Room air (11) is drawn into the sample chamber through the front grill at the work opening. In the air plenum before the primary HEPA filter, room air and the downflow air from the chamber mix (10) are drawn through the primary HEPA filter into the air plenum beyond the primary HEPA filter and continuing up to the motor plenum behind the interior rear wall of the sample chamber (9).

Secondary HEPA filters: From the motor plenum above the sample chamber, the primary filtered air is:

- drawn into the downflow fan (4) and pushed through the downflow filter (5) to be filtered again and entering the sample chamber as essentially particle free air.
- drawn into the exhaust fan (3) and pushed through the exhaust filter (2) and filtered again, returning to the room or thimble external exhaust transition (1) as essentially particle free air.

Airflow Sensor

An airflow sensor, located above the Exhaust HEPA filter (2), constantly monitors the flow of exhaust air out of the cabinet. If the exhaust falls below a safe level, the control board turns off the cabinet blower, and sounds an audible and visual alarm. This prevents the escape of hazardous material from the front of the cabinet, in the event of an exhaust system failure. The airflow sensor reading is shown on the display as Inflow in feet per minute (or m/s).

Note Never block or obstruct the grilles of the biological safety cabinets.

The internal ductwork of the biological safety cabinet conveys the air from the top of the cabinet to the blower, and then from the blower to the supply filter. The positive pressure rigid plenum of the biological safety cabinet is designed to deliver a more uniform airflow to the supply HEPA filter, optimizing filter loading and operational life.

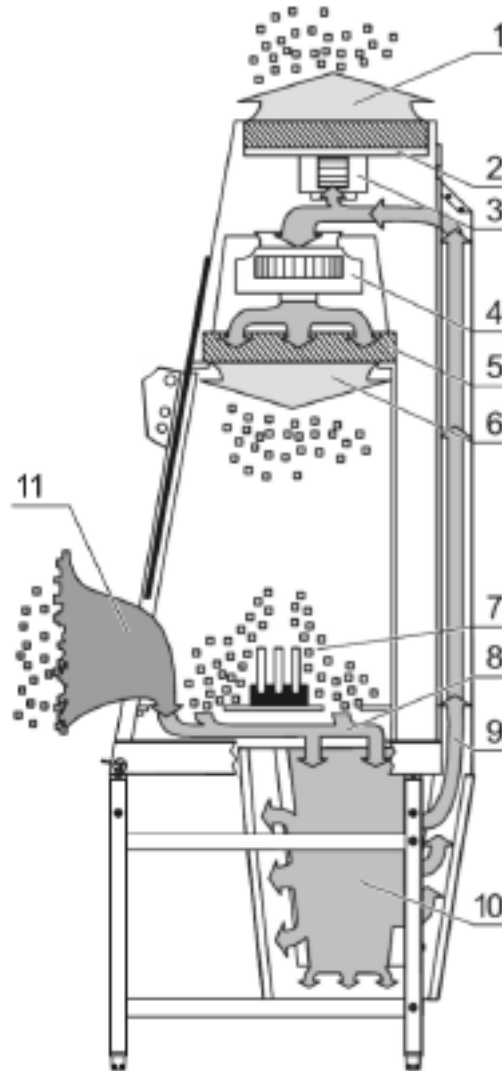


Figure 4-4 Filter system with primary filter, downflow filter and exhaust air filter / model Herasafe KSP

Controls and display

Fig. 4-5: The safety cabinet is equipped with two separate control elements that operate independently of each other:

- master switch [1]
- hand held control [3]

The status indicators of the display indicate control operations initiated with the control elements.

Hand held control: All device functions can be activated and deactivated easily using the hand held control.

Master switch: Use to control all standard functions required for daily operation. This switch allows you to operate the safety cabinet if the hand held control is not operational or available.

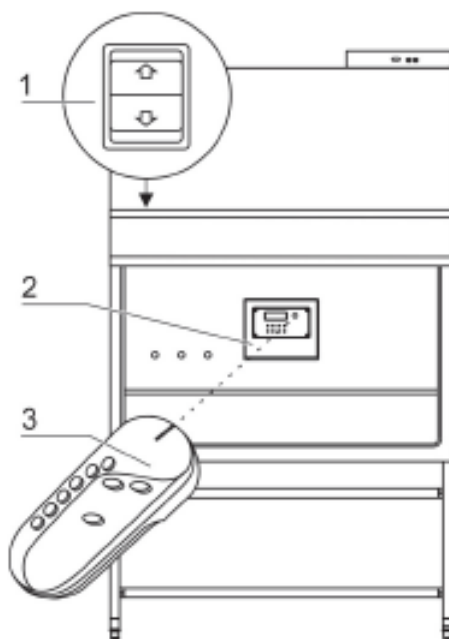


Figure 4-5 Controls and indicators

Fig. 4-6: The display [1] can show text or numeric values and has 12 LEDs [2 and 4] to indicate the current operational state of the unit.

The display module also houses the sensor system for the hand held control. The pulses transmitted are best received by the sensor if the distance **A** (aprox. 15 inch or 380 mm) between the hand held control [5] and the sensor [3] does not exceed 39 inches or 1 m and if the beam is within a 15° angle directly in front of the unit.

The transmission range of the hand held control also depends on the battery state of charge.

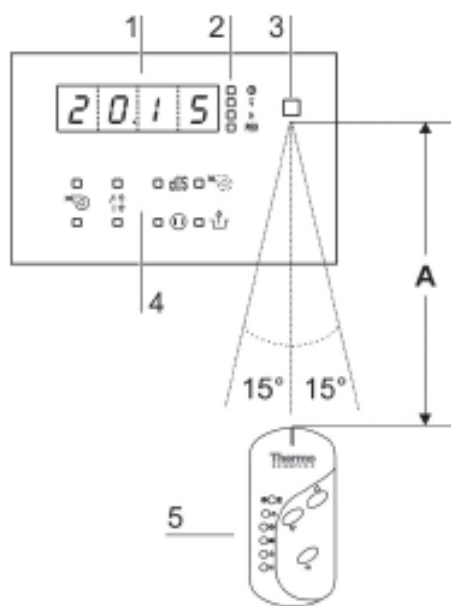


Figure 4-6 Display with hand held control sensor

Sample chamber access

Front cover:

The sample chamber of the device is accessible via two modes:

Fig. 4-7: Manual opening of the front cover [1] using the SmartClean^(TM) Plus feature allows access to the complete sample chamber width with an opening height C. It is generally needed for decontamination and introduction of larger accessories.

Note Front cover lockout

The front cover can only be opened in standby mode, when the front window is completely closed.

Optional equipment:

As an option, the front cover of both versions can be equipped with a safety feature: Two safety latches at the left and right frame struts secure the front cover from unauthorized opening. With this equipment, the function of the master switch is overridden by a safety bezel so that only the hand held control can be used to access the sample chamber.

If the hand held control is faulty, the safety bezel can be unscrewed and the device can be operated using the master switch (see Section “[Master switch](#)” on [page 6-13](#)).

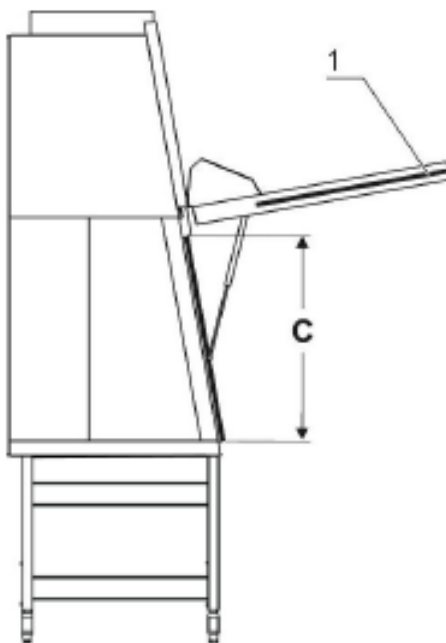


Figure 4-7 Access through front cover

Front window:

Fig. 4-8: The electrically operated front window [1] is made of laminated safety glass and integral to the front cover frame. It can be raised to a maximum opening height B. To access the sample chamber during the work process, the front window must stay in the work position with opening height A.



CAUTION Front window movement

Do not attempt to move the front window manually as otherwise the motor drive may be damaged.

Lowering the front window when the device is deenergized:

The safety feature is backed up by a battery (optional). Should a power failure occur, the master switch (see Section “Master switch” on page 6-13) can be used to lower the front window completely.

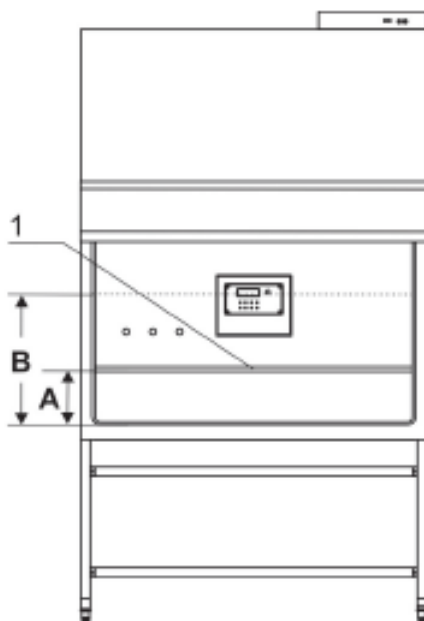


Figure 4-8 Access through front window

Device interfaces

Fig. 4-9: The standard equipment includes the outlets [10] for internal power supply as well as the openings [8] on both sides for routing of cables and hoses. All other supply connections are available as options.

Power supply connection: The connection to the power supply system is achieved through a cable with grounding plug [2] at the rear of the electrical box.

Contact connection: The front of the box has an RS 232 interface [3] for the connection to a PC as well as two fuse holders for 5A miniature fuses:

[4] for (L),

[5] for (N).

Note Electrical data of internal outlets

Rated voltage: 1/N/PE AC, 115 V / 60 Hz.

Fusing: T 5 A.

Maximum leakage current: 0.5 mA

Note Inlet pressure

Inlet pressure for media valves is: max. 80 psi (6 bar).

Internal power supply: There are two electrical outlets (5A) [10] and one UV disinfection adapter (optional) [9] located in the side walls.

Media valves: There are two sealed access ports [8] on each side. These may be used for installation of media valves [7].

Media supply lines: Additionally, media can be supplied into the sample chamber through three pipes (optional). The inlets [1] are located on top of the housing, the outlets [6] are placed at the sample chamber backpanel.

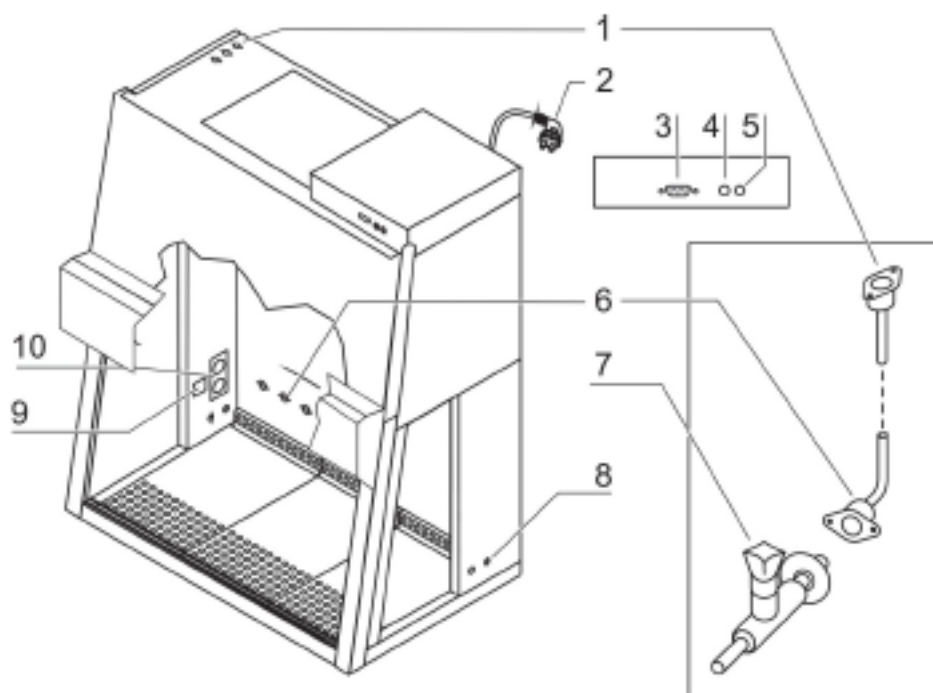


Figure 4-9 Supply interfaces

Disinfection adapter (optional), Fig. 4-9: The disinfection adapter [9] is used to connect a mobile UV radiation device. The adapter is connected to the device control, the UV disinfection routine with a mobile UV device may be controlled with the remote control.

Media connections (optional): The media supply unit consists of three pipes that are routed into the sample chamber through the top of the unit. The inlet connections [1] and outlet connections [6] with thread (R 3/8"), e.g. for media valves [7], are preinstalled and equipped with a sealing plug. The media connections are universal-type connections. Two equipotential bonding connections are installed at the top of the unit and at the stand.



CAUTION Combustible gas
Use only laboratory safety burners in the sample chamber.

External systems: A failure detection systems or gas supply solenoid valves may be connected to the safety cabinet control. The unit may also be connected to an external ventilation system.

Sample chamber illumination

Fig. 4-10: The work space illumination is equipped with two fluorescent tubes (3) that are installed behind the light dome (2).

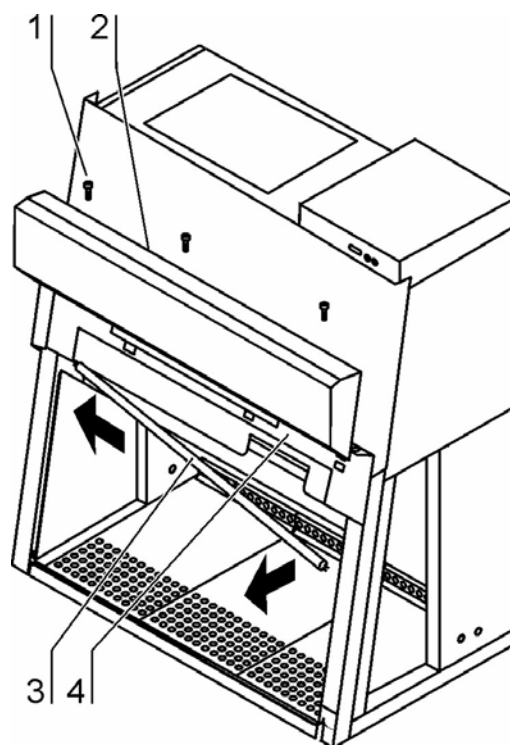


Figure 4-10 Sample chamber illumination

UV lamp unit

Fig. 4-11: The Herasafe KS/KSP can be ordered with the factory installed option cross-beam UV light, which minimizes shadows and improves the disinfection cycle. The UV lamp unit consists of two lamp housings [2] with two UV lamps each [1] that are integral to the side walls. Both lamp housings are protected by a stainless steel cover [3].

By cross-radiation of the UV units, all surfaces will be disinfected as the shadow zone is reduced. The operating time of the UV lamps is preset to 1 hour.

Note Protection from UV radiation

As a protection from harmful UV radiation, the UV lamps can only be activated if the front window is completely closed.

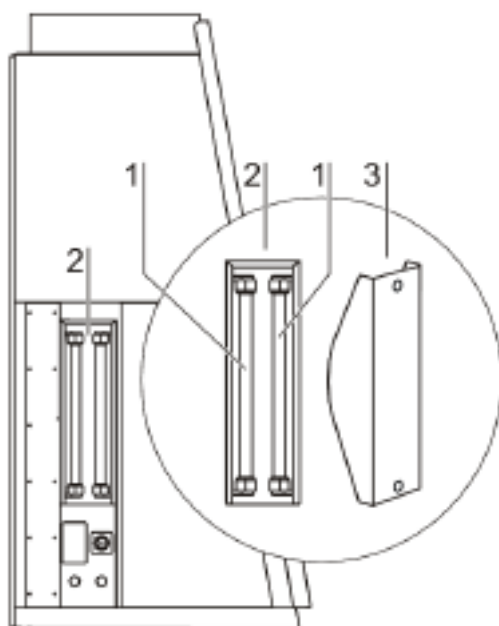


Figure 4-11 UV lamp unit

Working area

The standard equipment comprises the single-piece workplate for the Herasafe KS/KSP. Special workplates are available as optional accessories and will be supplied with the unit if ordered accordingly.

The workplate is placed onto the frame above the sample chamber floorpan using two submerging wire straps as handles.

Fig. 4-12: The working area **A** for material protection extends over the entire width **B** and depth **C** of the workplate module.

The two arm rests [3] are positioned at a distance **D** (7.8 inches or 20 cm) to each other centrally on the workplate segments (1). The armrests are installed to the second perforation line [2] of the workplate.

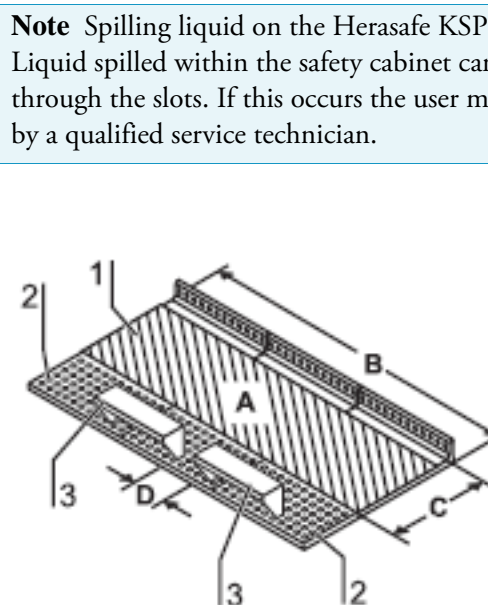


Figure 4-12 Working area on the workplate, armrests

Note Spilling liquid on the Herasafe KSP
Liquid spilled within the safety cabinet can penetrate the Herasafe KSP primary filters through the slots. If this occurs the user must have the safe function of the filters checked by a qualified service technician.

Installing exhaust system accessories

Fig. 4-13: The exhaust system components [1-4] are installed to the exhaust aperture [6] at the device ceiling. The four thread inserts [7] for the retaining screws [6] are preinstalled in the device ceiling.

To install the additional exhaust filter, additional holes must be drilled. For hole dimensioning and positioning, refer to the drilling template supplied with the separate installation instructions for additional exhaust filter.

Installation:

1. Switch the device off, disconnect it from the power supply system, and protect it from accidental reconnection.
2. Thoroughly clean the contact surfaces around the exhaust aperture and of the accessory to be installed to ensure that they are absolutely grease- and dust-free.
3. Apply sealant onto the contact surfaces.
4. Secure the accessory by tightening the supplied four retaining screws (M 5) finger-tight.
5. Remove any sealant coming out of the joint.

Connection to technical ventilation:

6. The exhaust manifold and the draft interruptor are installed between the safety cabinet and the exhaust pipe of the on-site exhaust system.
7. The supplied adapter [8] (Ø 8 in. (200 mm)) is screwed onto the aperture of the exhaust manifold or draft interruptor.

8. The pipe fitting can be installed to the exhaust manifold either at the top [9] or at the side aperture [10].

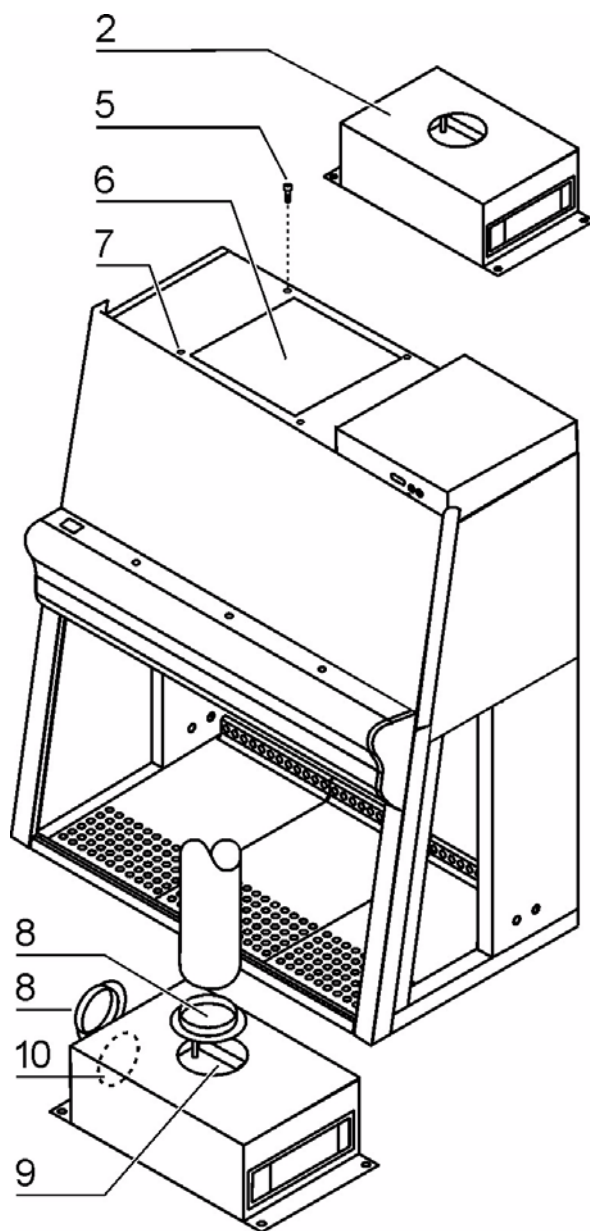


Figure 4-13 Exhaust system accessories

Unit description

Installing exhaust system accessories

Start-up

Initial operation

Prior to 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.

Model Herasafe KSP:

Upon the initial connection to the power supply system, the device control of version Herasafe KSP 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.

Installing unit and accessories

Model Herasafe KS:

Device without stand:

- Place the device without stand onto a sufficiently stable substructure so that the weight of the device frame rests on the lift points identified in Figure 3-2 and not solely on the floorpan.
- Remove the protective foil from the floorpan.

Device with stand:

To assemble the (optional) stand and to install the device frame to the stand:

1. **Fig. 5-1:** Slide the two crossmembers [2] onto the retaining angles [3] of the sidemembers [1]. Secure the crossmembers to the two sidemembers using the screws [4].
2. To attach the device frame [5] to the stand [7], install four Allen screws [6] loosely into the corresponding threaded holes at the underside of the device.
3. Place the biological safety cabinet [1] onto the stand so that the Allen screws [6] pass through the corresponding holes [8] of the retaining tabs [10].
4. Push the device frame [5] in the grooves [9] of the retaining tabs [10] all the way to the stop.
5. Tighten the four Allen screws [6].

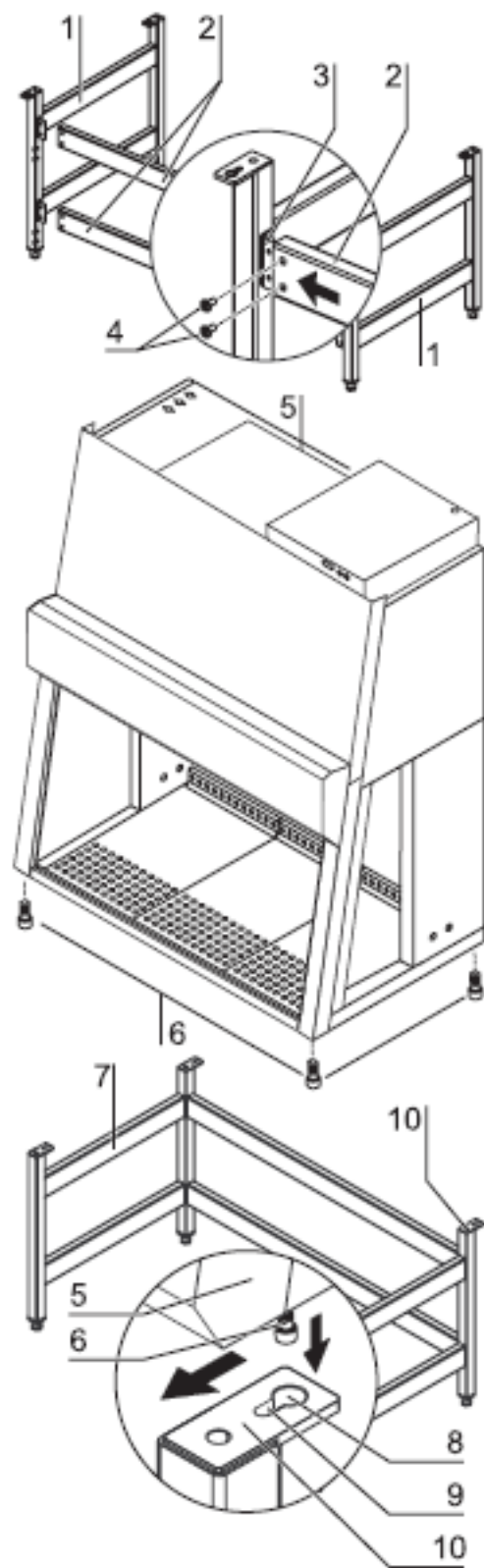


Figure 5-1 Stand installation model Herasafe KS

Model Herasafe KSP:

Fig. 5-2: The stand [3] and the primary filter housing form an assembly. To facilitate the installation of the device frame [1], the stand is equipped with a lifting mechanism.

The four columns [7] of the stand have threaded rods [6] onto which the device frame can be placed and lowered.

1. **Fig. 5-2:** Unscrew the threaded rods from their hex disks [5] by approx. 4 inches (10 cm) and make sure their height is identical on all four columns.
2. Place the biological safety cabinet onto the threaded rods. Check to see whether each guide pin [4] is seated perfectly in its receptacle at the lower device frame.
3. Screw in each threaded rod at its column in short, even intervals all the way to the stop of the hex disk.

Note Leveling the device

To level the device, do not use the lifting mechanism but only the adjustable stands of the device.

4. Align the working area of the biological safety cabinet:
Place a bubble level onto the workplate and rotate the adjustable leveling feet [2] of the stand using a wrench until the workplate is exactly horizontal in all directions. For the vertical alignment of the device stands, proceed from left to right and from rear to front.

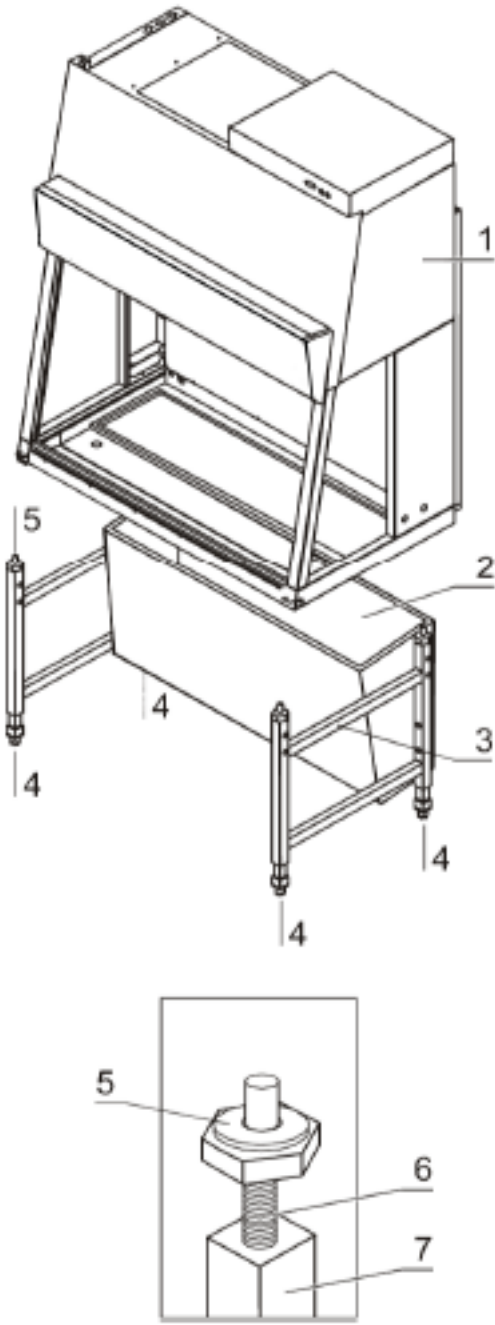


Figure 5-2 Stand installation model Herasafe KSP

Drain valve (optional)

Fig. 5-3: The drain valve [2] is installed into the floorpan opening [1] at the floor at the left front area of the sample chamber.

Note Installation

The optional drain valve must be installed only by authorized service personnel.



WARNING Drain valve lock

To prevent contaminated liquid from being accidentally drained from the floorpan, the drain valve can be secured using a conventional padlock.

1. Separate the sealant using a thin blade and remove the panel [3].
2. Remove silicone residues.
3. Place the drain plug [5] into the mounting hole of the floorpan.
4. Slide the cone disk [6] onto the drain plug with the conical side facing upward.
5. Install the nut [7] to the drain plug and tighten it so that the drain plug seals at the floorpan:
Secure the drain plug using a suited auxiliary, e.g. an angled Allen wrench [4].
6. Wrap sealing tape (teflon tape) around the drain plug [5], install the drain valve [2] to the drain plug using screws and tighten the screws; for tightening, secure the drain plug using a suited auxiliary.
7. Check the drain plug and the floorpan for possible leaks.

Start-up

Levelling the biological safety cabinet

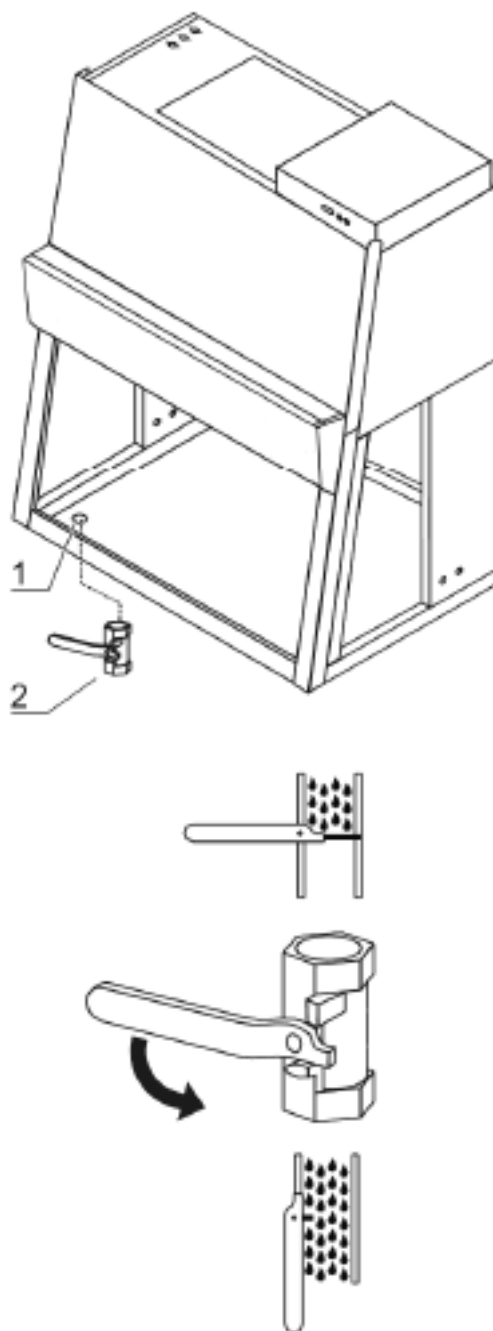


Figure 5-3 Drain valve installation

Levelling the biological safety cabinet

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

1. Remove transport protection (foil) from the workplate or from the workplate segments.
2. Lift the workplate or the workplate segments by the wire hooks and place it/them onto the front and rear rails in the sample chamber with the wide line of holes facing forward.

3. Device without stand: Place a bubble level onto the workplate and align the substructure until the bubble level indicates an exactly horizontal position in all directions.
4. Device with stand: Place a bubble level onto the workplate and use the four levellers of the stand to effect a level state in all planes.
When adjusting the device stand height, proceed from right to left and from rear to front.

Activating the hand held control

The hand held control operates on two batteries with the following specifications:

- 1.5 V alkaline cell (AAA, Type LR 03)

Installing the batteries:

1. **Fig. 5-4:** Open the lid [4] of the battery housing at the bottom of the hand held control by inserting a pointed instrument into the notch [1] and prying the lid off.
2. Insert the batteries [3]. The positive and negative poles are marked at the bottom of the battery housing.
3. The coding switch allows controllers and HERAsafe BSCs in close proximity to be set to different frequencies. The initial setting for a cabinet will be position 1. Check the position of the coding switch [2]. If the switch is not set to position 1, rotate it to that position.
4. Insert the two hinges of the lid into the joints at the battery housing and slightly press onto the lid so that the retaining clip engages.

Functional check:

After the biological safety cabinet has been connected to the power supply system, the function of the hand held control can be checked by switching on the light within the sample chamber. Point the hand held control toward the display at the sample chamber backpanel:

Press  key

Contamination protection:

If the hand held controller will be used inside the cabinet work area, protect the hand held control against dirt and contamination by using the disposable transparent covers provided.

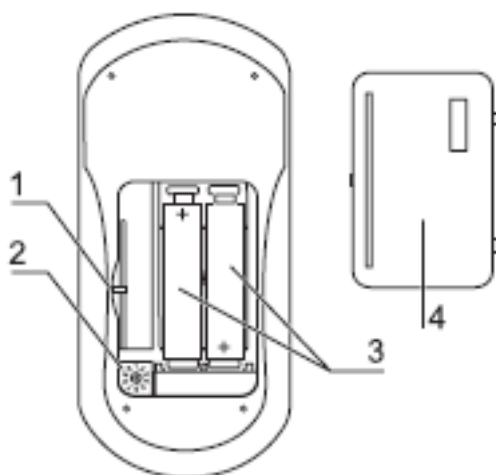


Figure 5-4 Inserting the batteries

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) are not correct, 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 ceiling of the cabinet 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 against accidental disconnection, the outlets for the connection to the power supply should be located outside the normal hand reaching range and must be accessible only to authorized personnel. Ideally, the outlets should be installed above the biological safety cabinet.

Connecting the grounding:

If the sample chamber is supplied with media (gas, water, etc.), the on-site grounding must be connected to one of the premounted threaded bushings either at the top of the housing or at the stand.

Initialization routine:

After the unit has been connected to the power supply system, the device control runs through a start-up initialization routine and switches the functions to the OFF mode. The biological safety cabinet is now operational and can be operated using the hand held control or the master switch

Presetting the alarm limits upon initial operation, Herasafe KSP:

Note Presetting the alarm limits
The alarm limits are set only upon the initial operation of the device.

Initial operation:

After the initialization routine has been completed, the calibration routine is run (Calibration routine, version KSP only):

- The display shows “CAL”.

- The routine starts automatically when the device control is in the work mode (see Section “Description of the operating modes” on page 6-3) and runs for approx 30 minutes. If the airflow is disturbed during the run time, the routine is cancelled and restarted automatically.
- At the end of the routine, the determined parameters for the alarm limits are saved.

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.

Setting the clock:

After the initialization routine has been run, the clock should be set to the appropriate time zone (see Section 7, [Operation](#)).

Note Power supply connection

The biological safety cabinet should remain connected to the power supply system at all times to ensure that settings for the individual unit configuration remain active in the memory. If the power supply is interrupted for more than 5 minutes, the time must be reset correctly.

After the power supply connection has been reestablished, the system switches to the operating mode that had been active last.

RS 232 interface connection

The RS 232 interface has been designed for a cable connection with 9-pin connectors and a contact assignment of 1:1.

Connection of the device:

1. Turn PC off.
2. **Fig. 5-5:** Connect the connector of the serial interface cable (not comprised in the scope of delivery) to the socket [1] at the supply interface at the front of the electrical box.
3. Connect the serial interface cable to an unassigned slot COM 1/COM 2 etc. at the PC.
4. Turn PC on.

Transfer protocol:

The interface must be configured as follows:

Baud:	9600
Data bits:	8
Parity:	none
Stop bit:	1
Protocol:	none
FIFO–puffer(extended modulation):	enabled

Occupancy of conductors:

Type of connector [X]: 9-Pin SUB-D

Pin 2: TxD

Pin 3: RxD

Pin 5: GND

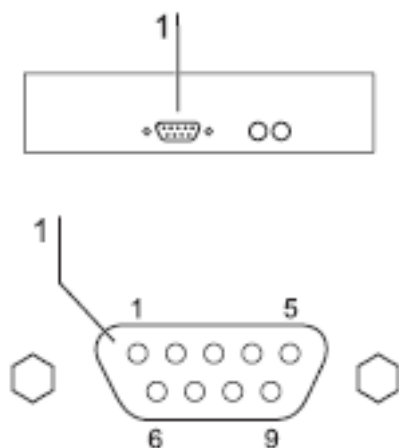


Figure 5-5 RS 232 interface connection

UV connection

Fig. 5-6: UV disinfection adapter (optional) for an external UV disinfection unit.

Voltage:

115 V

Current:

max. 1,1 A

Connectors:

[1], [2], [3] and PE-sign

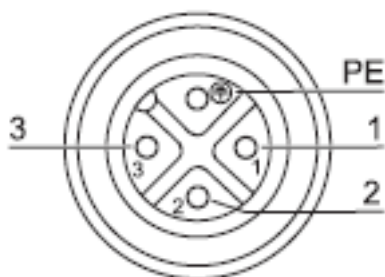


Figure 5-6 UV connection

Installation test

Do not operate the device before the installation test has been completed.

- The installation inspection of the device must be conducted in accordance with EN 12469/NSF 49, Annex F and additionally according to DIN 12980 for Herasafe KSP. The biological safety cabinet may be operated as a Class II microbiological safety cabinet type A2, 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 in Annex F:

- Inflow velocity test
 - Downflow velocity test
 - HEPA filters leak test
 - Airflow Smoke Pattern Test
- A repeat test must also be performed after repairs to the device or after major changes (more than 2 inch (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 start-up 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.

Handling and control

Display

Fig. 6-1: The display at the sample chamber backpanel shows

- status messages,
- parameter input and output.

Functions of the display components

[1] Display segment for numbers and text

Value displays

The LEDs 2-5 illuminate when the corresponding value is called up:

- [2] Display time (yellow LED), usually the active standard display
- [3] Display downflow velocity (yellow LED)
- [4] Operating hours after last filter replacement (yellow LED)
- [5] Display Performance Factor (yellow LED)

Function displays

The LEDs 6-9 illuminate only when the pertaining value is called up:

- [6] Ventilation reduced (yellow LED)
- [7] Potential-free contact activated (yellow LED)
- [8] Internal power supply activated (yellow LED)
- [9] UV disinfection routine activated (yellow LED)

Status displays

The LEDs 10/13 and 11/12 show the operating condition of the device as either/or conditions:

- [10] Front window **is not** in working position (red LED)
- [13] Front window **is** in working position (green LED)
- [12] Airflow **is** steady (green LED)
- [11] Airflow **is not** steady (red LED)

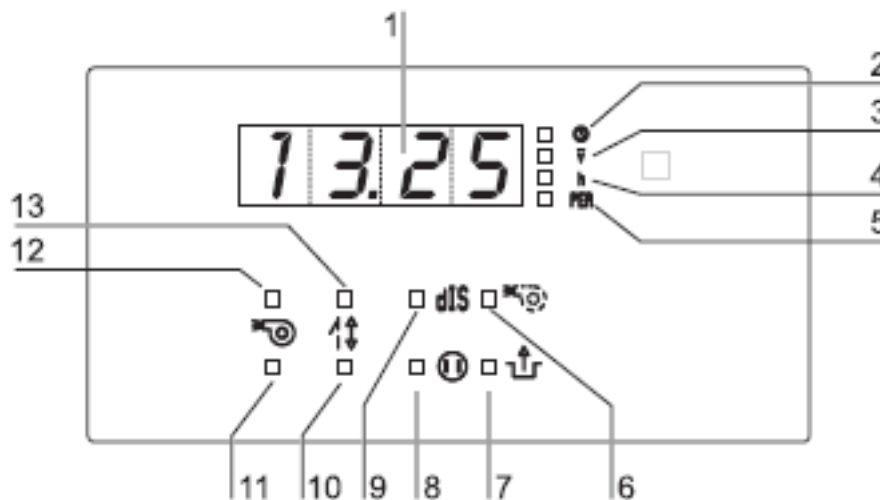


Figure 6-1 Functions of the display components

Display during the calibration routine

The routine runs for approx 30 minutes. During this time, the display shows alternately **cal** and the descending time value. If the calibration routine cannot be started due to faults, the display shows **cal** permanently.

Display in OFF mode

In the OFF mode, the display shows the current time.

For the initial start-up of the device, the clock must be set to the correct time zone and to the corresponding time output (CET mode or AM/PM mode) (see Section [“Setting the time”](#) on [page 6-8](#)).

Display in work mode

In the work mode, the display shows the values of the device data that had been shown last (see Section [“Setting the time”](#) on [page 6-8 ff](#)):

- Time (hours and minutes)
- Downflow velocity
- Operating hours after last filter replacement
- Performance Factor

Power interruption

If the master PCB of the device detects a power failure or a failure of the power supply, a warning is issued.

Note Power failure warning

In case of a power failure, the display goes off after 10 seconds, then an audible alarm signal sounds for about 30 seconds.

After this warning, the device is no longer operative.

The safety feature (optional) allows the complete lowering of the front window after a power failure by pressing the master switch.

Display and functions after a power failure

After the power supply has been reestablished after a power failure, the display shows the values and functions that were last shown prior to the failure.

The functions that had been selected last will be continued where they had been interrupted.

Failure messages

Failure messages are shown on the display as text/number combinations with the codes ER 1 to ER 6. If one of these codes appears on the display, contact Technical Service immediately.

Error code	Fault cause
ER 1	Pressure sensor 1/ supply
ER 2	Pressure sensor 2 / exhaust
ER 4	BUS error
ER 5	RAM error
ER 6	Error hand held control

Description of the operating modes

The following operating modes exist for the device:

- Calibration mode (after initial start-up, version KSP)
- OFF mode
- Work mode
- Standby mode (Night-set-back mode)
- UV mode

OFF mode: The device is at "idle". Utilized for charging the sample chamber or for cleaning and disinfection, the front cover can be opened when the front window is completely closed.

- The air system blowers are switched off.
- The sample chamber illumination is available.
- The internal power supply within the sample chamber is available:
 - If the internal power supply is activated, the yellow status indicator INTERNAL POWER SUPPLY ACTIVATED is illuminated.
- The display shows the time. If the timer has been activated, the display alternately shows the current time and the preset switching time for the timer.
- The contact for the external device connection is **not** available.

Work mode: Ensures personal and material protection. In this operating mode, the work process is run within the sample chamber. The device is in the work mode when the front window has been moved into the working position and the airflow is steady.

- The front window is in the working position:
 - The green status indicator FRONT WINDOW IS IN WORKING POSITION is illuminated.
 - 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 available.
- The power supply for the sample chamber outlets is available:
 - If the internal power supply is ON, the yellow status indicator INTERNAL POWER SUPPLY ACTIVATED is illuminated.
- The monitor-contact for the external device connection is available:
 - If the contact is activated, the yellow status indicator POTENTIAL-FREE CONTACT ACTIVATED is illuminated.

Standby mode: For an interruption of the work process, the front window can be lowered and the sample chamber sealed aerosol-tight. The air system output has been 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 IS NOT IN WORKING POSITION is illuminated.
 - The yellow status indicator AIRFLOW REDUCED is illuminated.
- The sample chamber illumination is available.
- The internal power supply in the sample chamber is available:
 - If the internal power supply is ON, the yellow status indicator INTERNAL POWER SUPPLY ACTIVATED is illuminated.

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 available.
- The internal power supply in the sample chamber is **not** available.
- The integral UV lamp (optional) is available.
- The power supply for the UV disinfection adapter (optional) is available.

Hand held control

The device control software monitors the selected operating mode of the biological safety cabinet and automatically deactivates operating functions that are not in accordance with the safety requirements of the mode.

The hand held control has priority over the master switch.

Basic functions

Fig. 6-2: The simple operation of the hand held control allows the user to control all basic functions using a minimum of operating steps to switch the biological safety cabinet into work mode.

► **Switching the device into work mode:**

Keep the **SEt** key depressed until the ready signal sounds


► **Moving the front window up:**

Press the ▲ key for approx. 1 second

When the front window reaches the working position, the movement stops automatically.
When the movement starts above the working position, the front window stops at the maximal opening position.

► **Stopping the upward movement:**

Press, then release the ▲ key

This function can be selected with any key except the  key.


► **Lowering the front window:**

Keep the ▼ key depressed

► **Stopping the downward movement:**

- Release the ▼ key

► **Silencing the audible alarm signal, (see section “[Silencing the audible alarm signal](#)” on [page 6-7](#)):**

Press the  key

► **Switching the device to OFF mode:**

Keep the **SEt** key depressed until the ready signal sounds

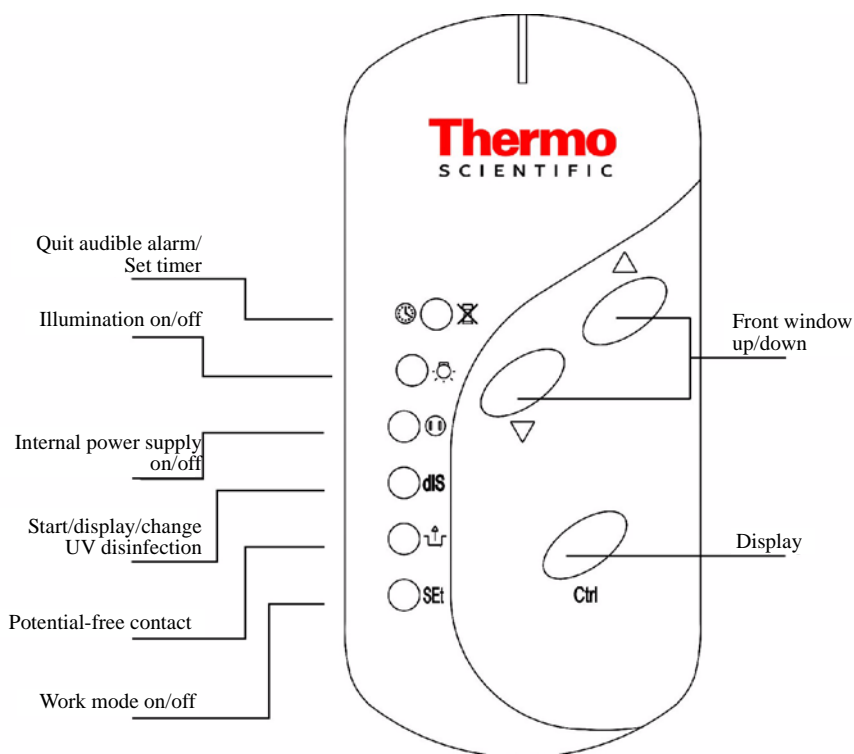


Figure 6-2 Basic functions of the hand held control

Availability of functions in the different operating modes: x = available

Key	Mode			
	OFF mode	Work mode	Standby mode	UV mode
SEt	x	x	x	x
▲		x	x	
▼		x	x	
	x	x	x	
	x	x	x	
dIS		x	x	x
	x	x	x	x
Ctrl	x	x		
		x		

Moving the front window to the working position

1. Raising or lowering the front window:

Press, then release the ▲ key for approx. 1 second

The red status indicator on the display is illuminated

The audible alarm signal is on.
2. When the front window reaches the working position, the movement is automatically stopped.

The green status indicator on the display is illuminated

The audible alarm signal is off if the airflow is steady.
3. If the movement starts above the working position, the front window must first be lowered below the working position and then be raised again. To lower the front window:

Keep the ▼ key depressed
4. To stop the downward movement:

Release the ▼ key

Silencing the audible alarm signal

When the front window is moved out of the working position or when the pressure sensors detect a safety-relevant change of the airflow velocities, the corresponding visual and audible alarm signals are issued. To silence the audible alarm:

- Press, then release the  key

Note Ending the visual alarm signal

The optical alarm signals can not be deactivated while the alarm condition exists.

Switching the illumination on and off

In each operating mode, the sample chamber illumination can be switched on or off.


1. To switch the illumination on or off:



Press, then release the  key

Activating and deactivating the internal power supply


All outlets in the sample chamber can be activated (power supply on) or deactivated (power supply off) simultaneously.



1. To activate the power supply:

Press, then release the  key

The yellow status indicator   is illuminated.

2. To deactivate the power supply:

Press, then release the  key

The yellow status indicator   goes off.

Displaying the UV disinfection time

This value refers to the operating hours of the set run time of the UV disinfection or of the power supply for the UV disinfection adapter (optional). This display function is only available when the front window is not closed. The device must be switched to work mode.

1. To display the value:

- Press, then release the **dIS** key

The time value is output in segments of 30 minutes.

2. To deactivate the value display:

The value display is deactivated automatically after 2-3 seconds.

Switching the biological safety cabinet to OFF mode

The unit can be switched to OFF mode from any other operating mode:

- Keep the **SEt** key depressed until the ready signal sounds

Setting the time

The current time of the time zone in which the unit operates must be set at the start-up of the biological safety cabinet. Two different display modes can be selected:

- CET mode (24:00 hours)
- AM/PM mode (12:00 hours)

When the time is to be set, the device must be in the OFF mode.

1. Set the time:

Keep the **Ctrl.** key depressed until the two-digit hour display flashes.

The minute display shows either A, P or no value (CET time display). The time zone is set at the same time as the hour value: First, set the time zone (sequence: CET, A, P), then set the exact hour value.

2. While increasing or decreasing the hour value in increments, set the time zone:

Press, then release the ▲ or the ▼ key

3. Scroll through values:

Keep the ▲ or the ▼ key depressed

If the keys are depressed for approx. 2 or 3 seconds, a higher scroll speed is selected.

4. Store the hour and time zone setting:

Press the **Ctrl.** key

The function switches to minute display (flashing).

5. Set the minutes:

Press, then release the ▲ or the ▼ key

6. Scroll through values:

Keep the ▲ or the ▼ key depressed

If the keys are depressed for approx. 2 or 3 seconds, a higher scroll speed is selected.

7. Store the minute value:

Press, then release the **Ctrl.** key

The display shows the time.

Note Displaying BSC status

The following data can be called up in succession:

- Time (hours/minutes)
- Downflow velocity
- Operating hours after last filter replacement
- Performance factor

To call up values in succession:

- Press, then release the **Ctrl.** key for each value

The following three sections contain detailed information about displaying values.

Calling up the Performance Factor value.

The value should only be called up after the airflows have stabilized for at least 20 min.

Displaying the downflow velocity

The sensor system of the device continuously monitors the downflow velocity of the airstream in the sample chamber. The currently determined value (m/s) can only be called up in the operating mode.


- To display the velocity value:

Press the **Ctrl.** key repeatedly until the yellow E LED illuminates.

Displaying the operating hours of the HEPA filters

The filter total operating hours after the last filter replacement can be displayed. Upon each filter replacement, the hours are reset to zero.

1. To display the total operating hours:

Press the **Ctrl.** key repeatedly, until the yellow status indicator  h on the display is illuminated.

2. The value indicates the full hours.

Displaying the Performance Factor

The Performance Factor (PER) is a value that indicates the safety state of the biological safety cabinet. This value is calculated from data determined by the biological safety cabinet safety system and from values captured empirically by service personnel during safety checks. This data is entered into a parameter list of the control software and interconnected. The result can be indicated by the display.

1. To call up the PER:

Press the **Ctrl.** key repeatedly until the yellow status indicator  PER on the display is illuminated.

The PER is displayed as an integer.

2. To evaluate the PER:

Number in the 100 to 60 range: The biological safety cabinet is operationally safe. Personal and material protection is ensured.


Number in the 59 to 30 range: The biological safety cabinet is still operationally safe. Personal and material protection is ensured. The safety system should be checked.

Number in the 29 to 0 range: The safety of the device may be impaired. The failure causes must only be repaired by authorized service personnel. Contact Technical Service.

Setting and activating the timer

The timer function allows you to switch the biological safety cabinet from the OFF mode to the work mode at a predetermined time. The timer can only be set when the device is in the OFF mode.

1. To set the switching time:

Keep the  key depressed until the ready signal sounds

The display flashes the two-digit hour display.

2. Increase or decrease the hour value in increments:

Press, then release the ▲ or the ▼ key

3. Scroll through the value display:

Keep the ▲ or the ▼ depressed

If the keys are depressed for approx. 2 or 3 seconds, the higher scroll speed is selected.

4. Store the hour setting:

Press, then release the **Ctrl.** key

The function switches to minute display (flashing).

5. Set the minute value:

Press, then release the ▲ or the ▼ key



6. Scroll through the value display:

Keep the ▲ or the ▼ depressed

If the keys are depressed for approx. 2 or 3 seconds, the higher scroll speed is selected.

7. Store the minute value and activate the timer:

Press, then release the **Ctrl.** key

The status display   flashes. After a moment, the display shows the current time again. When the value is stored, the timer is automatically activated.

If the setting is not stored, the switching time will be reset to the original value after approx. 15 seconds.

Note Activating the timer

If the timer is to be activated without a prior change of the time values, the procedure above is performed and the existing time values are confirmed:

Press, then release the Ctrl. key for each value.

After the minute value has been confirmed, the timer has been activated.

Note Timer function

The timer can not be used as a start routine that calls up its function automatically.

It must be reactivated separately for each deferred device start.



Deactivating the timer

If the device was started at a preset time, the timer function is also deactivated automatically. The deferred start can therefore be cancelled only while the device is still in the OFF mode.

- To deactivate the timer function for starting the device:

Keep the **SEt** key depressed until the ready signal sounds

The biological safety cabinet changes to the work mode.

The status indicator   illuminates continuously, and the display shows the current time.

Setting the UV disinfection time

Depending on the equipment option of the biological safety cabinet, this setting is used to:

- determine the disinfection time of the optional UV lamps in the side walls or
- set the time for the power supply of a mobile UV device at the UV adapter.

Factory setting is one hour. The time can be set within a range between 0 and 24 hours in increments of 30 minutes each. The unit must be in the work mode (the front window must not be closed). For each following start of the UV disinfection, the routine is run with this preset time value.

1. Select the function:

Keep the **dis** key depressed until the ready signal sounds

The display flashes the run time that had been selected last.

2. Set or change the disinfection time. To increase the value in increments:

Press, then release the **▲** or the **▼** key

3. Scroll through the value display in increments of 30 minutes:

Keep the **▲** or the **▼** key depressed

4. Store the setting:

Press, then release the **Ctrl.** key

If the setting is not stored, the disinfection time will be reset to the original value after approx. 15 seconds.

Starting the UV disinfection

The UV disinfection can only be started if the front window is completely lowered (standby mode). Depending on the equipment of the unit version, this function is used to:

- switch on the optional UV lamps in the side walls or
- activate the power supply for the outlets of the mobile UV device.
- Start the routine:

Keep the **dis** key depressed until the ready signal sounds

The display alternately shows the Text **dis** and the remaining disinfection time in hours and minutes.

The yellow status indicator  **dis** is illuminated.


After the disinfection time has elapsed, the current time is displayed.

Cancelling the UV disinfection

While the UV disinfection routine is run, it can be interrupted at any time.

1. Cancelling the routine:

- Press, then release the **dis** key

The status indicator  **dis** goes off.


2. The display shows the current time.

Also the routine is cancelled by opening up the front window.

Activating the stop watch

The stop watch function starts a countdown for a preset time (max. 99 min and 59 s) and issues an audible signal when the set time has elapsed. The signal cannot sound if some other device function has already caused an alarm. The function can only be activated if the device is in the work mode.

1. Select the stop watch function:

Keep the  key depressed until the ready signal sounds

2. Set the minutes (0 - 99) in increments:

Press, then release the **▲** or the **▼** key

3. Scroll through the value display:

Keep the ▲ or the ▼ depressed

If the keys are depressed for approx. 2 or 3 seconds, the higher scroll speed is selected.

4. Store the minute setting:

Press, then release the **Ctrl.** key

The function switches to second display (flashing).

5. Set the second value (0 - 59):

Press, then release the ▲ or the ▼ key

6. Scroll through the value display:

Keep the ▲ or the ▼ depressed

If the keys are depressed for approx. 2 or 3 seconds, the higher scroll speed is selected.

7. Store the setting and start the stop watch:

Press, then release the **Ctrl.** key

8. Indication of the function:

The predefined time value counts to zero.

Master switch

Fig. 6-3: If the hand held control is not available, the basic functions required for the operation of the device can be controlled with the master switch:

- switch the device on,
- raising and lowering the front window,
- silencing the audible alarm signal,
- switching the device to OFF mode.

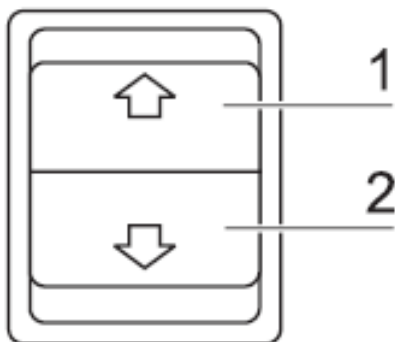


Figure 6-3 Basic functions of the master switch

Moving the front window:

The movement of the front window is controlled by depressing the master switch control element with the corresponding arrow symbol.

1. To raise the window, press and hold the control element [1]. When the front window reaches the working position, the movement stops automatically. If the movement starts above the working position, the front window stops at the maximal opening position.
2. To stop the upward movement, release the control element.
3. To lower the window, keep the control element [2] depressed.
4. To stop the downward movement, release the control element.

Note Switching functions (on/off)

If the device is started with the master switch, the chamber illumination is switched on.
If the device is switched off with the master switch, the chamber illumination is also switched off.

5. If the front window is not in the working position,
 - the red status indicator FRONT WINDOW IS NOT IN WORKING POSITION is illuminated.
 - the audible alarm signal can be silenced (i.e. switched off) if the front window is either completely closed or has been moved to the maximum upper opening position.
6. When the front window reaches its working position, the movement stops automatically:
 - The green status indicator FRONT WINDOW IS IN WORKING POSITION is illuminated.
 - The audible alarm signal is switched off.

Silencing the audible alarm signal:

1. Move the front window to the upper and lower end positions.
2. Release the control element.
3. Press, then release the control element. The audible alarm signal remains off.

Switching the device to OFF mode

1. Move the front window to the upper and lower end positions.
2. Release the control element.
3. Keep the previously actuated control element depressed until the ready signal sounds.

Note Switch-off function

If the device is switched to the OFF mode with the master switch, the chamber illumination is switched off. The device-internal power supply remains in the last functional state that it had been switched to.

Operation

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.

Preparing the sample chamber

Installing the accessories:

1. Lower the front window completely.
2. Open the front cover or move the front window into the maximum opening position.
3. Position the accessories in the working area of the workplate.
4. Close the front cover.
5. Move the front window to its working position and wait until the airflow has stabilized.



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 working position, stop all applications that may release harmful aerosols.

Note Application of handling hazardous drugs

For the application of handling hazardous drugs, the indented one-piece worktray must be used in the Herasafe KSP according to DIN12980.

6. Then place samples into the chamber.
7. To put the cabinet into reduced flow or night mode, close the window without turning off the cabinet. The window will provide an aerosol tight seal, the blowers will slow and maintain the cleanliness and containment of the sample chamber.

Response to failure messages

Failure messages are displayed in form of text/number combinations with a code between ER 1 and ER 6 (see chapter “[Display and functions after a power failure](#)” on [page 6-3](#)). If one of these codes is displayed, contact the Technical Service 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 biological safety 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.

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. 7-1: 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 an almost horizontal position.

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

To ensure a compensation between floor and sitting height, a footrest (optional accessory) should be used.

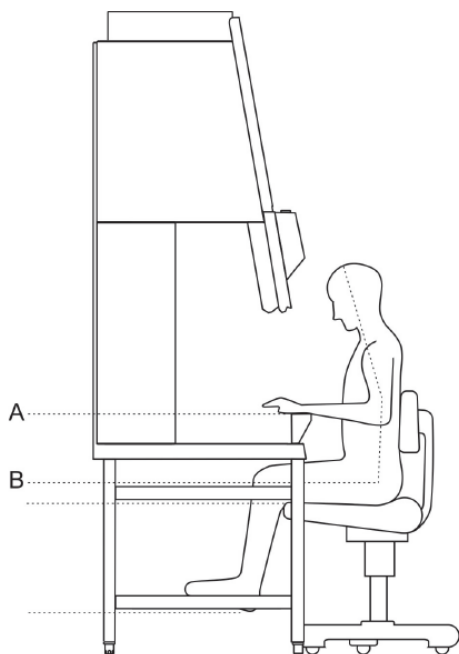


Figure 7-1 Sitting posture

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.

Shut-down

Interrupting an operation

To interrupt a work process, the device is switched to the OFF mode.

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 OFF mode by keeping the ON key depressed until the indicators go off (a dot in the right display segment remains as a voltage signal indicator).

Shutting the unit down

If the unit is not to be used for an extended period of time, it should be completely decontaminated.



CAUTION 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.

Note Removing the batteries

To prevent the batteries from leaking and to prevent their contacts from oxidizing during extensive operation intermissions, remove the batteries from the hand held control and store them in a dry place.

The nickel-metalhydride battery backup for the safety feature “Lower front window” is leakproof and can remain installed.

Shut-down

Shutting the unit down

Cleaning and decontamination

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 biological safety cabinets used for microbiological experiments.

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

Decontamination 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 and the armrests.

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

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

Wipe/spray disinfection

The wipe/spray disinfection is performed in three stages:

- Predisinfection,
- cleaning,
- final disinfection

Recommended disinfectants:

Note Compatibility

Chloride-containing disinfectants may damage some surfaces. Therefore, use only disinfectants that do not contain chloride.

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.

Disinfectants based on quaternary ammonium compounds are acceptable for use and compatible with all components.

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 front window to the working position.
7. Allow disinfectant to react as recommended by 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. Wipe the surfaces clean using a clean cloth and plenty of clear water.
2. Remove dirt residues and deposits thoroughly.
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 with disinfectant.
2. Allow disinfectant to react as recommended by manufacturer.

UV disinfection after a wipe/spray disinfection

A UV disinfection can be performed either by using the optional integral cross-beam UV lamps or by using a mobile UV device. The run time of the routine can be preset with the hand held control.

UV disinfection using the integral UV lamps

To start the UV disinfection routine:

1. Remove the stainless steel covers from the lamp mountings in the side walls.
2. Lower the front window completely.
3. Start the UV disinfection using the hand held control.

UV disinfection using a mobile UV device

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 to the UV disinfection adapter.
2. Lower the front window completely.
3. Start the UV disinfection using the remote control.

Decontamination with formaldehyde

Procedure:

For decontamination, formaldehyde is evaporated in the tightly sealed sample chamber. The quantity of the formaldehyde used depends on the sample chamber volume of the biological safety 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 biological safety cabinet location should be approx 69.8 °F (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 decontamination with formaldehyde must be performed in accordance with the specifications of NSF 49/1992, Annex G.

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

Cleaning the exterior surfaces

Wipe the exterior surfaces of the device clean using a solution of tepid water and commercial dishwasher solution. Then, wipe exterior surfaces dry using a soft, clean cloth.

Cleaning the floorpan

Clean the floorpan using a solution of tepid water and commercial dishwasher.

1. Remove the working plates 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 working plates.

Maintenance

Field Certification

PER is the value that indicates the safety state of the biological safety cabinet by monitoring various device parameters.

- If PER shows a value below 60, the device should be inspected.
- Independent of the PER value, the biological safety cabinet must be inspected on an annual basis.

The annual certification comprises the following checks:

- Functional test of the device.
- Checking all components for possible damage.
- Checking the filter state.

Note Perforated plate

The Perforated plate at the blanket of the sample chamber serves for the protection of the downflow filter and prevents refluxing.

While scanning the filter surface for leak test the perforated plate must be built-in.

- Verifying device air flows
- Checking the airflow conditions.
- Repeat test in accordance with NSF/ANSI 49.

Service

Filter replacement:

As the filter replacement requires access to potentially contaminated portions of the cabinet, filters must only be replaced by adequately trained and authorized service personnel.

Note Filter replacement

Before filters are replaced the appropriate decontamination and safety procedures must be completed.

After the filter replacement, a certification test must be performed in accordance with NSF/ANSI 49.

UV lamps

The UV lamps should be replaced after 1500 operating hours:

1. Remove cover from lamp housing.
2. Rotate the lamp in the socket so that the lamp contacts can be removed from the groove in the socket.
3. Insert the new lamp into the socket and rotate until the contacts engage.
4. Replace cover.

Sample chamber illumination

The sample chamber is illuminated by two fluorescent tubes [3]. The sprung tube sockets are installed at the front door mounting frame [4].

1. Switch the device off, disconnect it from the power supply system, and protect it from accidental reconnection.
2. Remove the three retaining screws [1] from the light dome [2] and remove the dome.
3. The fluorescent tubes are mounted in rotating sockets. Rotate the tube carefully into the removal position, then remove it from the socket.
4. Insert the new tube and rotate it into the working position.
5. Position the light dome at the mounting frame and secure it using the three retaining screws.

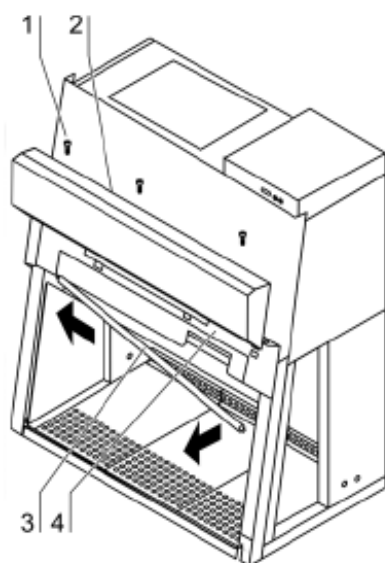


Figure 10-1 Fluorescent tube

Replacing the front window seal

Fig. 10-2: When the front window seal shows visible sign of wear, the seal must be replaced. The sealing is slipped onto the housing frame and secured by an additional retaining strip at the lower edge of the sample chamber opening.

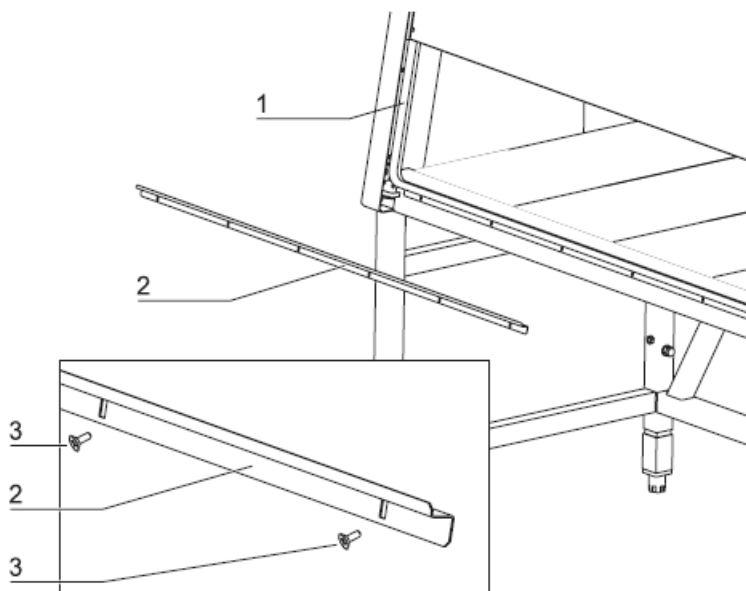


Figure 10-2 Front window seal replacement

1. Lower the front window completely and open the front cover.
2. Remove the retaining screws [3] and remove the retaining strip [2].
3. Remove the seal [1] from the housing frame retaining lip.
4. Slip the groove of the new seal onto the housing frame retaining lip and push it on so that the seal fits evenly along the entire sealing surface.
5. Secure the retaining strip with the screws.

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 work are interferences with the safety system of the unit. 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.

Routine Maintenance Schedule

Weekly

- Using 70% ethanol, or a suitable disinfectant, surface disinfect the inside of the biological safety cabinet and the work surface.
- Using an appropriate glass cleaner to clean the sash and the surface of the UV lamp, if so equipped.
- Operate the biological safety cabinet blower, noting the percent filter life remaining in an operational log.

Monthly (or more often as required)

- Using a damp cloth and clean the exterior surfaces of the biological safety cabinet, particularly the front and top of the biological safety cabinet to remove any accumulated dust.
- Disinfect and lift the work surface. Surface disinfect the lower plenum with a solution of 70% ethanol, or a suitable disinfectant. Check the towel catch for retained materials.
- Check all service valves, if so equipped, for proper operation.
- Check the UV and fluorescent light hourmeters, and record their readings in an operational log.
- Check the prefilter for cleanliness; replace if needed.
- All weekly activities.

Semiannually or Annually

- Have the biological safety cabinet re-certified by a qualified certification technician.
- All monthly activities.

Certification Testing

Classification of the Biological Safety Cabinet

For application in the USA, the unit has been rated as a Class II biological safety cabinet, Type A2, in accordance with NSF/ANSI Standard 49/2009.

For operation as a unit of said classifications, a certification test and repeat test in accordance with NSF/ANSI Standard 49-2009, Annex F should be completed at the time of installation, and at least annually thereafter. As described in Annex F, recertification should be performed whenever HEPA filters are changed, maintenance repairs are made to internal parts, or the biological safety cabinet is relocated. More frequent recertification should be considered when working with safety-critical materials.

Test Terms

Nominal value:

Default value as specified by manufacturer.

Measured value:

Value measured at the location of the biological safety cabinet.

Tolerance:

Acceptable deviation from the nominal value.

Average value:

The sum of the measuring values divided by the number of tests. The average value is compared to the nominal value.

Setpoint:

Acceptable operating value for the inflow and downflow velocities.

Inflow velocity (FPM):

Velocity of the air entering the sample chamber opening.

Downflow velocity (FPM):

Velocity of the displacement flow circulating through the work chamber.

Exhaust velocity (FPM):

Velocity of the airflow discharged through the exhaust filter opening.

Exhaust airflow volume (CFM):

Amount of air discharged at the exhaust filter.

Testing

According to NSF/ANSI Standard 49/2009, tests related to the safety of the personnel, product and environment that must be conducted on-site for Class II, Type A2 biological safety cabinets, at a minimum frequency of annually, are;

- downflow velocity profile test
- inflow velocity test
- airflow smoke patterns test
- HEPA filter leak test
- site installation assessment tests
 - alarm functions
 - exhaust system performance (proper exhaust duct negative pressure and canopy performance).

As described in Annex F, in addition to the above, the following tests performed at the request of the customer, or at the discretion of the certification provider.

- comfort and safety tests
 - lighting intensity
 - noise level
 - vibration
 - electrical leakage, ground circuit resistance and polarity tests

Note Service with costs:
Unless certification was expressly called for in the specification, quotes and/or purchase order, the cost for this on-site testing is to be paid for by the customer.

Test Equipment

For conducting these tests, Thermo recommends testing equipment of the manufacturers listed below.

Testing equipment	Manufacturer	Application
Smoke tubes	MSA Pittsburgh, Pennsylvania, 15230	Airflow pattern test
Thermoanemometer	TSI Shoreview, Minnesota 55126	Downflow velocity test
Digital Safety Inspector	Ohmic Instruments Co. Easton, Maryland 21601	Electrical leakage and ground resistance tests
GFI Circuit Tester	Leviton Manufacturing Little Neck, New York, 11362	Electrical leakage, ground resistance, and polarity tests
Photometer	Air Techniques Owing Mills, Maryland, 21117	Filter leak test

Testing equipment	Manufacturer	Application
Aerosol Generator	Air Techniques Owing Mills, Maryland, 21117	Generation of aerosol mist
Vibration Meter	Quest Technologies Oconomowoc, Wisconsin, 53066	Vibration test
Flow Hood Airdata Multimeter	Shortridge Instruments. Inc. Scottsdale, Arizona, 85260	Downflow velocity test and alternate method for inflow velocity using constricted access

Testing Information

Inflow Velocity – DIM Method (Primary)

Description: Inflow velocity using the direct inflow measurement method (DIM).

Equipment:...Shortridge ADM-870, or equivalent

..... Flow hood Series 8400, or equivalent

Method:

1. Move the front window to the work position (10 in./25.4 cm).
2. Attach the flow hood [1] in the work opening [2] and seal the remaining open areas.
3. Operate the system blowers for approx 20 min.
4. Record at least 5 measurements of the inflow air volume.
5. Average those readings and calculate the inflow velocity (V1) as described below.

Inflow Area:

- 3 ft model KS 2.43 sq ft (0.23 m²)
- 4 ft model KS 3.25 sq ft (0.3 m²)
- 5 ft model KS 4.07 sq ft (0.38 m²)
- 6 ft model KS 4.89 sq ft (0.45 m²)
- 3 ft model KSP 1.92 sq ft (0.18 m²)
- 4 ft model KSP 2.56 sq ft (0.24 m²)
- 5 ft model KSP 3.21 sq ft (0.3 m²)
- 6 ft model KSP 3.85 sq ft (0.36 m²)

Calculation:

- Inflow Velocity (V1) = Inflow Air Volume (V2)/Actual Inflow Area (A2)

Acceptance:

- 100 – 110 FPM

Correction measures:

- Enter the service level and activate S2, change S2 until the desired velocity is reached and save the new value.
- If the velocity can't be adjusted due to clogging of the filters, change the exhaust filter.
- If the filter is in order, change the exhaust blower.

Note Check of alarm limits: If S1 or S2 are changed, the alarm limits S3 and S4 must be checked and saved again.

Inflow Velocity – Constricted Window Method (Secondary)

Description:

- Inflow velocity measured over several points through a constricted window.

Equipment:

- Thermal Anemometer, or equivalent (hotwire)
- Adhesive tape

Method:

1. Lower the front window to a height of 3 in. (7.6 cm).
2. Operate the system blowers for approximately 20 minutes.
3. Insert the thermal anemometer probe into the work chamber. Attach the probe to the inside of the front window with adhesive tape. See **Figure 11-1**. Adjust the probe so the air passing through probe is centered in the window opening (1.5 in. [3.8 cm]).

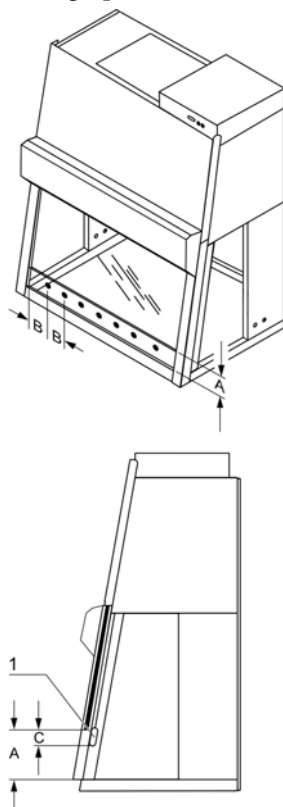


Figure 11-1 Constricted Window Method

4. Beginning 5.9 inches in from the left inside wall, record successive readings every 5.9 inches (7 readings for 4 foot models and 11 readings for 6 foot models).
5. Average those readings and calculate the inflow velocity (V1) as described below.

Calculation:

- Inflow velocity (V1) = average of actual inflow velocity * factor * 0.3

Acceptance:

- 100 – 110 FPM

Refer to the data plate on the right side of the front cover.

Downflow Velocity – Uniform Biological Safety Cabinet

Description:

- Measures the velocity of air flow onto the work surface through the supply filter.

Equipment:

- Thermal Anemometer, or equivalent (hotwire)
- Freestanding Fixture, or equivalent

Method:

1. Operate the unit in the work position for approximately 20 minutes.
2. Insert the anemometer probe into the probe stand, adjusting for a height of 4 inches (10 cm) for the KS and 2 inches (5 cm) for the KSP above the bottom edge of the window opening while in the work position.
3. Record the readings on a horizontal plane 4 inches (10 cm) above the bottom edge of the window opening while in the work position, in a grid pattern not to exceed 6 inches (15 cm) x 6 inches (15 cm).

Grid Pattern:

- 3 foot models KS and KSP

21 points								6
								5.65
								5.65
								6
	6	3.91	3.91	3.91	3.91	3.91	3.91	6 inches

- 4 foot models KS and KSP

21 points

									6
									5.65
									5.65
									6
6	5.88	5.88	5.88	5.88	5.88	5.88	5.88	6	inches

- 5 foot models KS and KSP

27 points

										6
										5.65
										5.65
										6
6	5.88	5.88	5.88	5.88	5.88	5.88	5.88	5.88	6	inches

- 6 foot models KS and KSP

33 points

											6
											5.65
											5.65
											6
6	5.88	5.88	5.88	5.88	5.88	5.88	5.88	5.88	5.88	6	inches

Calculation:

- Average Downflow Velocity = Sum of all measurements / Number of readings

Correction measures:

- Enter the service level and activate S1, change S1 until the desired velocity is reached and save the new value.
- If the velocity can't be adjusted due to clogging of the filters, change the supply filter.
- If the filter is in order, change the supply blower.

Note Check of alarm limits: If S1 or S2 are changed, the alarm limits S3 and S4 have to be checked and saved again.

HEPA Filter Leak Test

Description:

- Determines the integrity of the downflow and exhaust filters.

Equipment:

- Aerosol Photometer, or equivalent

- Aerosol Generator, or equivalent

Note

- Important adjustment that must be made prior to making any measurements
Nominal airflow through the particle counter should always 1.00 (one) cf/min and/or 28.3 l/min, if possible. Airflow should be monitored during measurement. Adjust the airflow as described in user manual of particle counter.
- Check that the indicated flow rate is nominal. During measurement of the raw air concentration the air flow should be not lower 85% (0.85).
- Do not forget that for the measurement of the flow-off side of the HEPA-filter (clean air concentration) to adjust the airflow back to 1 cft/min. One cft/min means one cubic foot of air passes through the sensor in one minute.

Filters that can be Accessed and Scanned

Method:

1. Allow the biological safety cabinet to operate for approximately 20 minutes.
2. Remove the work tray and protective covers, as appropriate.
3. Introduce the aerosol from the generator in the center rear of the work area, using a tee fitting to evenly distribute the aerosol.
4. If desired, and if the biological safety cabinet has not been used with hazardous materials since an effective decontamination, the upstream concentration can be measured. If desired, connect the photometer sample hose to the appropriate (supply or exhaust) test hose connection (exhaust test hose - right side / supply test hose - left side) from under the work tray.
5. Using either the appropriate upstream challenge measurement or calculated challenge value, set the photometer accordingly.
6. Scan the downstream side and perimeter of the filter as prescribed in NSF/ANSI 49-2009, Annex F.

Acceptance:

- Filters scanned – 0.01% of upstream concentration at any point

Filters that cannot be Accessed or Scanned

Method:

1. Set up as in Steps 1 through 5 above
2. In the duct, downstream of the filter, sample in accordance with NSF/ANSI Standard 49, 2009.

Acceptance:

- Filters not scanned – 0.005% of upstream concentration

Airflow Pattern Test

Description:

- Determines the internal and external behavior of the air movement.

Equipment:

- Cold smoke (titanium tetrachloride)

Method:

- Downflow:
Pass smoke across the centerline of the work surface, 4 inches (10 cm) above the work opening.
- View Screen Retention:
Pass smoke 1 inch (2.5 cm) behind the window opening, 6 inches (15 cm) above the work opening.
- Work Opening Edge Retention:
Pass smoke around the entire outside work opening, approximately 1.5 inches (3.8 cm) away from the biological safety cabinet.
- Window Seal Test:
Pass smoke up both sides and across the top of the window opening from inside the work area, approximately 2 inches (5 cm) from the edges.

Acceptance:

- No smoke shall have dead spots, reflux or escape the biological safety cabinet once drawn in.

Elect. Leakage, Ground Resistance, Polarity Tests

Description:

- Refer to UL 61010-1

Site Installation Assessment Tests

Description:

- Verify the unit is integrated properly into the facility.

Airflow Alarms

Description:

- Verify the airflow alarms will activate within 15 seconds when there is a 20% loss.

Equipment:

- Thermal Anemometer or equivalent (hotwire)
- Adhesive tape
- Shortridge ADM-870 or equivalent
- Flowhood series 8400 or equivalent

Method:

- Downflow:
Enter the service level and activate S03.
Verify that the average downflow velocity is 20% lower than the rated velocity by following the method described previously. Change and save S03 if needed and leave the service level. Enter the service level again and set S01 to the value of S03 -0.5%. The LED “AIRFLOW STABLE” must change from green to red. Leave the service level without saving this value by pressing the “acknowledge alarm” key.
- Inflow:
Enter the service level and activate S05.
Verify that the inflow velocity is 20% lower than the rated velocity by following one method described previously. Change and save S05 if needed and leave the service level.
Enter the service level again and set S02 to the value of S05 -0.5%.
The LED “AIRFLOW STABLE” must change from green to red. Leave the service level without saving this value by pressing the “acknowledge alarm” key.

Acceptance:

- Unit alarm activates within 15 seconds when the downflow and inflow velocity is set to the correct values and the LED “Airflow STABLE” changes from green to red (as described above).

Sash Alarms

Description:

- Verify the window alarms are operating properly

Equipment:

- Operating manual

Method:

- Raise the window 1 inch (2.5 cm) above work position

Acceptance:

- Window alarm activates

Exhaust System Performance

Description:

- Verify the exhaust system is functioning properly

Canopy Connections

Equipment:

- Cold smoke (titanium tetrachloride)

Method:

- Pass smoke around the air gap, to ensure negative pressure exists

Acceptance:

- No smoke refluxes back into the room once drawn into the canopy

Note Standard: For additional and detailed information regarding these tests, refer to NSF/ANSI Standard 49, 2009.

Disposal

Disposal procedure

Discarded biological safety cabinets or unit components contain reusable materials. All components with the exception of the HEPA filters can be disposed of after having been thoroughly cleaned and disinfected. The HEPA filters must be disposed of 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 as specified by the appropriate safety officer.



Recyclable materials!

Component	Material
Thermal insulation components	Polystyrene foam, EPS/PPS compound
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 cover seal	EMPP
Front window, side windows	Multi-layer safety glass
Operating panel and indicator foil	Polyethylene
Workplates	Stainless steel
UV bezels	Stainless steel
Armrests	Stainless steel
Batteries	Alkaline cells
Accu (safety feature: Lower Front Window)	Nickel/metal hydrid

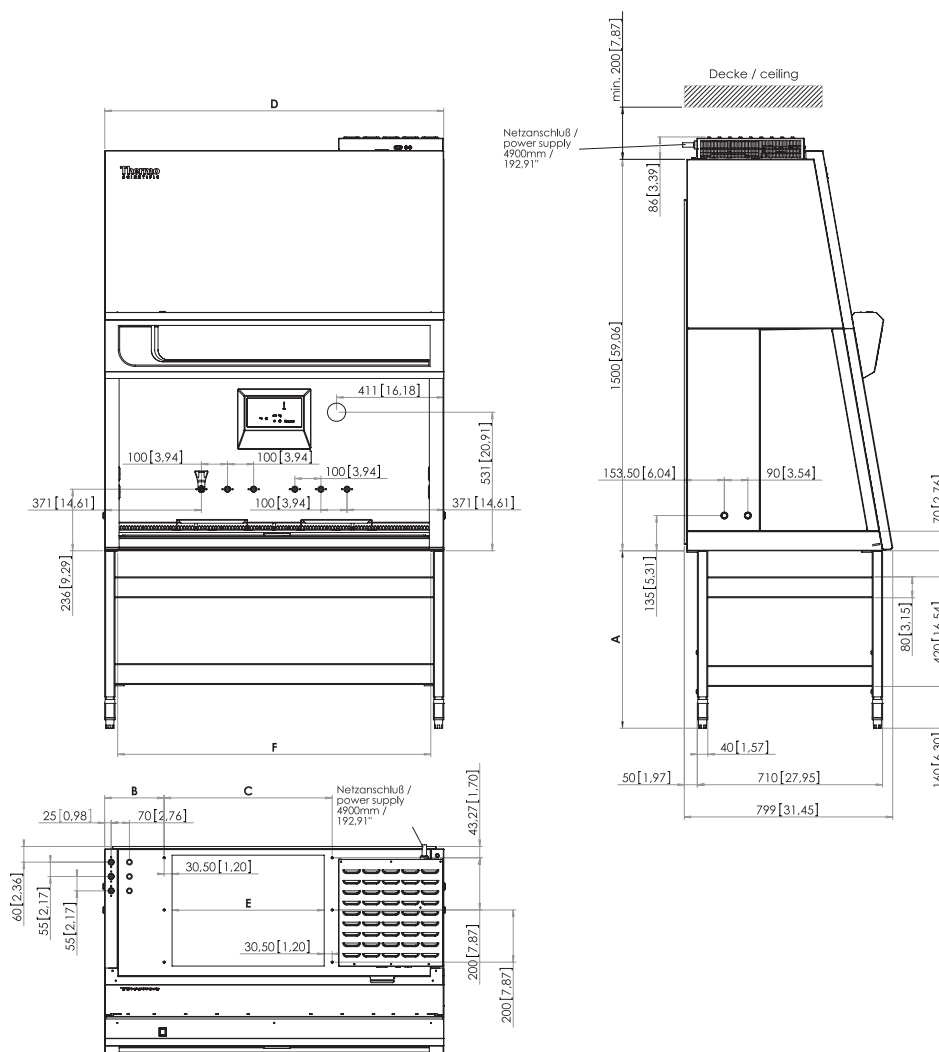
WEEE Compliance:

This product is required to comply with the European Union's Waste Electrical and 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 EC Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo products which may assist the detection of substances subject to the RoHS Directive are available at www.thermo.com/WEEERoHS.

Technical data

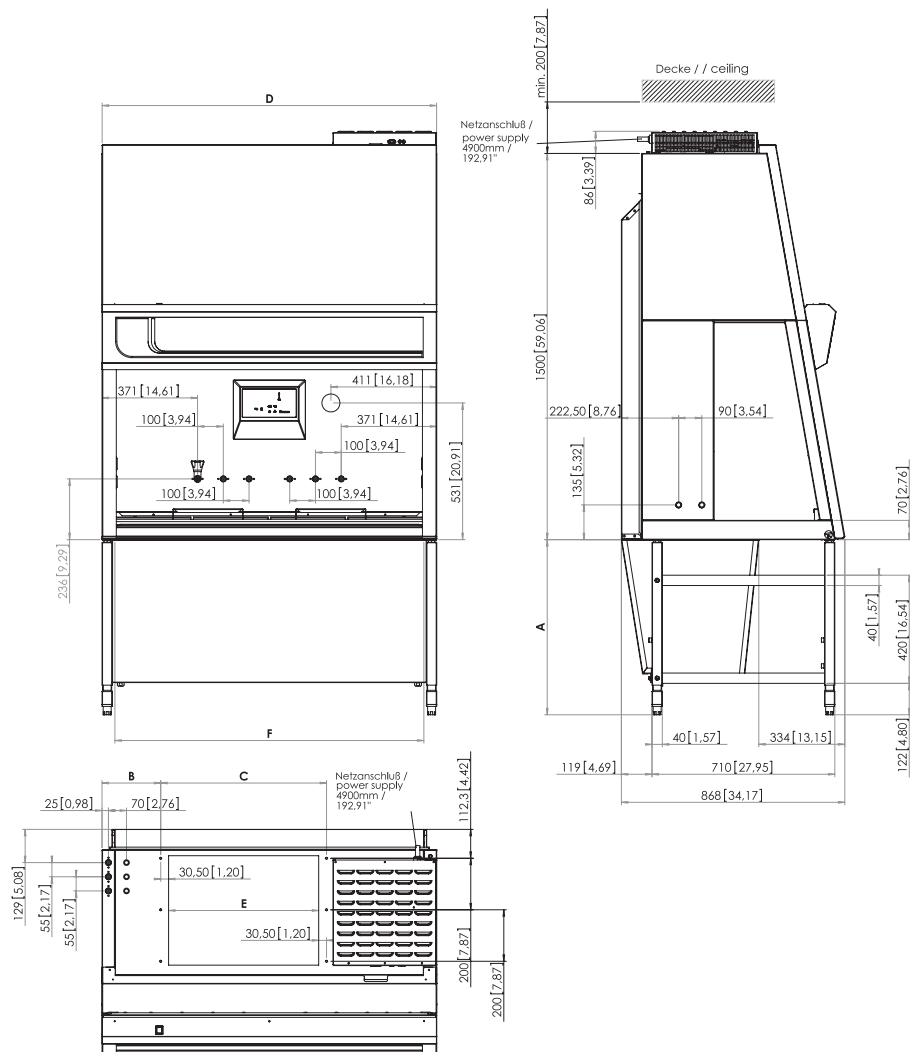


	A
Sitzarbeitsplatz (min)	680mm
seated work position	26,77"
Steharbeitsplatz (max)	880mm
standing work position	34,65"

Achtung: Beim Einbau der Mediendurchführungen seitlich, muss mit einer größeren Gerätebreite D geplant werden.

Attention: With additional gas valves in the side walls, a more width dimension D must be planned.

	B	C	D	E	F
KS 9	81mm	491mm	1000mm	430mm	900mm
	3,19"	19,33"	39,37"	16,93"	35,43"
KS 12	228mm	644mm	1300mm	583mm	1200mm
	8,97"	25,35"	51,18"	22,95"	47,24"
KS 15	478mm	644mm	1600mm	583mm	1500mm
	18,82"	25,35"	62,99"	22,95"	59,05"
KS 18	474,5mm	951mm	1900mm	890mm	1800mm
	18,68"	37,44"	74,80"	35,04"	70,86"



	A
Sitzarbeitsplatz (min)	680mm
seated work position	26,77"
Steharbeitsplatz (max)	880mm
standing work position	34,65"

Achtung: Beim Einbau der Mediendurchführungen seitlich, muss mit einer größeren Gerätebreite D geplant werden.

Attention: With additional gas valves in the side walls, a more width dimension D must be planned.

	B	C	D	E	F
KSP 9	81mm	491mm	1000mm	430mm	900mm
	3,19"	19,33"	39,37"	16,93"	35,43"
KSP 12	228mm	644mm	1300mm	583mm	1200mm
	8,97"	25,35"	51,18"	22,95"	47,24"
KSP 15	478mm	644mm	1600mm	583mm	1500mm
	18,82"	25,35"	62,99"	22,95"	59,05"
KSP 18	474,5mm	951mm	1900mm	890mm	1800mm
	18,68"	37,44"	74,80"	35,04"	70,86"

Dimensions					
HERAsafe		KS/KSP 9	KS/KSP 12	KS/KSP 15	KS/KSP 18
Exterior dimensions KS/KSP					
Width	mm/inches	1000/39.37	1300/51.18	1600/62.99	1900/74.80
Depth	mm/inches	800/870 / 31.50/34.25			
Height	mm/inches	1580/62.20			
Interior dimensions KS/KSP					
Width	mm/inches	900/35.43	1200/47.24	1500/59.06	1800/70.86
Depth	mm/inches	630/24.80			
Height	mm/inches	773/30.43			
Front opening KS					
Front window					
Working position	mm/inches	254/10			
Max. opening	mm/inches	773/30.43			
Front opening KSP					
Front window					
Working position	mm/inches	200/7,87			
Max. opening	mm/inches	773/30.43			
Working area height KS/KSP					
Fixed rack	mm/inches	750/29.53			
Height-adjustable rack	mm/inches	750-950/29.53-37.40			
Stand height					
Fixed rack	mm/inches	680/26.77			
Height-adjustable rack	mm/inches	680-880/26.77-34.65			
Unit height with stand KS/KSP					
Fixed rack	mm/inches	2260/88.98			
Height-adjustable rack	mm/inches	max. 2460/max. 96.85			
Side wall feed through KS/KSP					
Diameter	mm/inches	23/0.91			
Distance lower edge	mm/inches	130/5.12			
Distance from backpanel					
Bushing 1	mm/inches	160/6.30			
Bushing 2	mm/inches	250/9.84			

Optional media connections in chamber backpanel					
HERAsafe		KS/KSP 9	KS/KSP 12	KS/KSP 15	KS/KSP 18
Diameter	inches	NPT 3/8	NPT 3/8	NPT 3/8	NPT 3/8
Outer distance left					
Connection 1	mm/inches	370/14.57			
Connection 2	mm/inches	470/18.50			
Connection 3	mm/inches	570/22.44			
Outer distance right					
Connection 4	mm/inches	570/22.44			
Connection 5	mm/inches	470/18.50			
Connection 6	mm/inches	370/14.57			

Electrical data					
HERAsafe		KS/KSP 9	KS/KSP 12	KS/KSP 15	KS/KSP 18
Voltage					
Rated voltage	V	1/N/PE AC, 120V - 50/60 Hz			
Blower voltage	V	48 V / DC			
Current					
Power consumption	A	9.2	9.2	12.0	12.0
Leakage current IEC1010, EN61010	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			
Power					
Power input	W	1379	1379	2000	2000
Protection					
Protection class		I			
Protection type		IP 20			
Overvoltage category (IEC 1010, EN 61010)		II			
Contamination degree (IEC 1010, EN 61010)		2			
Connecting lines					
Connecting lines		Cable (4.9 m)			

Pressure					
HERAsafe		KS/KSP 9	KS/KSP 12	KS/KSP 15	KS/KSP 18
Pressure media valves	bar/psi	max. 6/87			

Volume, weights, and loads					
HERAsafe		KS 9	KS 12	KS 15	KS 18
Volume					
Unit volume	m ³ /cf	1.1/38.9	1.4/49.4	1.7/60.0	2.1/74.2
Floorpan	l/cf	30/1.1	40/1.4	50/1.8	60/2.1
Weights					
Cabinet	kg/lbs	170/375	200/441	230/507	280/617
Stand AFS1	kg/lbs	26/57.3	26/57.3	27/59.5	27/59.5
Stand AFS2	kg/lbs	30/66.1	30/66.1	31/68.3	31/68.3
Loads					
Max. load per working area module					
	kg/lbs	25/55.1			
Max. load on overall working area					
	kg/lbs	50/110.2	75/165.4	75/165.4	75/165.4

Volume, weights, and loads					
HERAsafe		KSP 9	KSP 12	KSP 15	KSP 18
Volume					
Unit volume	m ³ /cf	1.4/49.4	1.7/60.0	2.1/74.2	2.7/95.4
Floorpan	l/cf	4/0.14	5/0.18	6/0.21	7.5/0.26
Weights					
Cabinet	kg/lbs	200/441	240/529	280/617	330/728
Loads					
Max. load per working area module					
	kg/lbs	25/55.1			
Max. load on overall working area					
	kg/lbs	50/110.2	75/165.4	75/165.4	75/165.4

Airflow system					
HERAsafe		KS 9	KS 12	KS 15	KS 18
Airflows					
Airflow velocities					
Inflow	m/s/FPM	0.53/105			
Downflow	m/s/FPM	0.36/70	0.38/75	0.36/70	0.36/70
Air volume					
Overall volume flow	m ³ /h/CFM	1126/663	1568/923	1880/1107	2257/1328
Downflow volume flow	m ³ /h/CFM	692/407	988/582	1153/679	1384/815
Exhaust air volume inflow	m ³ /h/CFM	434/255	580/341	726/427	872/513

Airflow system					
HERAsafe		KSP 9	KSP 12	KSP 15	KSP 18
Airflows					
Airflow velocities					
Inflow	m/s/FPM	0.45/89			
Downflow	m/s/FPM	0.32/63			
Air volume					
Overall volume flow	m³/h/CFM	910/536	1220/718	1520/895	1820/1071
Downflow volume flow	m³/h/CFM	620/365	830/489	1040/612	1240/730
Exhaust air volume inflow	m³/h/CFM	288/170	386/227	483/284	580/341

Filters					
HERAsafe		KS/KSP 9	KS/KSP 12	KS/KSP 15	KS/KSP 18
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			
Downflow					
Width	mm/inches	915/36.02	1220/48.03	1525/60.04	1830/72.05
Depth	mm/inches	457/18			
Height	mm/inches	93/3.66			
Exhaust air					
Width	mm/inches	457/18	610/24.02		915/36.02
Depth	mm/inches	457/18	457/18		457/18
Height	mm/inches	117/4.61	117/4.61		117/4.61

Prefilters					
HERAsafe		KSP 9	KSP 12	KSP 15	KSP 18
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			
Width	mm/inches		100.5/3.96		

Prefilters				
Depth	mm/inches		278/10.94	
Height	mm/inches		575/22.64	

Ambient conditions					
HERAsafe		KS 9	KS 12	KS 15	KS 18
Temperature					
Max. ambient temperature during operation	°C/°F	40/104			
Min. ambient temperature during operation	°C/°F	10/50			
Humidity					
Max. humidity /operation	% r. H.	90			
Max. gumidity /storage	% r. H.	95			
Heat dissipation to environment					
Room temperature 25° C/ 77° F	W/BTU/hr	170/580	210/717	275/938	350/1194
Room temperature rise					
Above room temperature with window closed	°K	< 2	< 2	< 2	< 2
Ergonomics					
Noise level	dB (A)	65			
		The noise level was determined in accordance with DIN EN ISO 3744. 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.			

Ambient conditions					
HERAsafe		KSP 9	KSP 12	KSP 15	KSP 18
Temperature					
Max. ambient temperature during operation	°C/°F	40/104			
Min. ambient temperature during operation	°C/°F	10/50			
Humidity					
Max. humidity /operation	% r. H.	90			
Max. gumidity /storage	% r. H.	95			
Heat dissipation to environment					
Room temperature 25° C/ 77° F	W/BTU/hr	200/682	240/819	305/1041	420/1433
Room temperature rise					
Above room temperature with window closed	°K	< 2	< 2	< 2	< 2
Ergonomics					

Technical data

Ambient conditions					
Noise level	dB (A)	56	56	58	58
		The noise level was determined in accordance with DIN EN ISO 3744. 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.			

Device log

[illegible]

Certificate of decontamination

ThermoFisher
SCIENTIFIC

Declaration

Notification no.	Notification date	Page 1/1
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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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S C I E N T I F I C

Internet: <http://www.thermo.com>