Please read this manual thoroughly to familiarize yourself with the many unique features and exciting innovations we have built into your new equipment. Esco provides many other resources at our website, www.escolifesciences.com, to complement this manual and help you enjoy many years of productive and safe use of your Esco products.

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User Manual

Cytoculture®

Cytotoxic Safety Cabinet
Model Code : CYT-_A1

Esco Cytoculture® Cytotoxic Safety Cabinet A Series Customized User Manual
Version A - Released October 2024

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INTRODUCTION

USER SECTION

Warranty Terms and Conditions

Esco products come with a limited warranty. The warranty period will vary depending on the product purchased, beginning on the date of shipment from any Esco international warehousing location. To determine which warranty applies to your product, refer to the appendix below.

Esco's limited warranty covers defects in materials and workmanship. Esco's liability under this limited warranty shall be, at our option, to repair or replace any defective parts of the equipment, provided that these parts, if proven to the satisfaction of Esco, were defective at the time of being sold and that all defective parts shall be returned, properly identified with a Return Authorization.

This limited warranty covers parts only, and not transportation/insurance charges.

This limited warranty does not cover:

- Freight or installation (inside delivery handling) damage. If your product was damaged in transit, you must file a claim directly with the freight carrier.
- Products with missing or defaced serial numbers.
- Products for which Esco has not received payment.
- Problems that result from:
  - External causes such as accident, abuse, misuse, problems with electrical power, improper operating environmental conditions.
  - Servicing not authorized by Esco.
  - Usage that is not in accordance with product instructions.
  - Failure to follow the product instructions.
  - Failure to perform preventive maintenance.
  - Using accessories, parts, or components not supplied by Esco.
  - Damage by fire, floods, or acts of God.
  - Customer modifications to the product.
- Consumables such as filters (HEPA, ULPA, carbon, pre-filters) and LED / UV bulbs.
- Esco is not liable for any damage incurred on the objects used on or stored in Esco equipment. Users are advised to conduct risk assessment and add safety protocols based on their application and sample.

Factory installed, customer specified equipment or accessories are warranted only to the extent guaranteed by the original manufacturer. The customer agrees that in relation to these products purchased through Esco, our limited warranty shall not apply, and the original manufacturer's warranty shall be the sole warranty in respect of these products. The customer shall utilize that warranty for the support of such products and in any event not look to Esco for such warranty support.

Esco encourages all users to register their equipment online at https://www.escolifesciences.com/services/warranty-registration or complete the warranty registration form included with each product.

ALL EXPRESS AND IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN TIME TO THE TERM OF THIS LIMITED WARRANTY. NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, WILL APPLY AFTER THE LIMITED WARRANTY PERIOD HAS EXPIRED. ESCO DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES PROVIDED FOR IN THIS LIMITED WARRANTY OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, ANY LIABILITY FOR THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES, FOR PRODUCTS NOT BEING AVAILABLE FOR USE, OR FOR LOST WORK. ESCO'S LIABILITY WILL BE NO MORE THAN THE AMOUNT YOU PAID FOR THE PRODUCT THAT IS THE SUBJECT OF A CLAIM. THIS IS THE MAXIMUM AMOUNT FOR WHICH ESCO IS RESPONSIBLE.

These Terms and Conditions shall be governed by and construed in accordance with the laws of Singapore and shall be subject to the exclusive jurisdiction of the courts of Singapore.

Technical Support, Warranty Service Contacts
USA: 1 215-441-9661
Singapore: +65 6542 0833
Global Email Helpdesk: support@escolifesciences.com
Visit https://www.escolifesciences.com/ to talk to a Live Support Representative
Distributors are encouraged to visit the Distributor Intranet for self-help materials.

Product Appendix, Warranty Listings

Products	No. of years
Animal Research Workstations	3 years limited
Biological Safety Cabinets (except Streamline brand)	3 years limited
Cleanroom Equipment	1 year limited
CO_2 Incubators	2 years limited
Containment/Pharma Products	2 years limited
Ducted Fume Hoods	2 years limited
Ductless Fume Hoods	2 years limited
Formalin Vaporizer	1 year limited
Laboratory Centrifuge	2 years limited
Laboratory Freezer	2 years limited
Laboratory Ovens and Incubators	1 year limited
Laboratory Refrigerator	2 years limited
Laminar Flow Cabinets	3 years limited
Orbital Shaker	1 year limited
PCR Cabinets	3 years limited
PCR Thermal Cyclers	2 years limited for MiniPro, Aeris, Swift Progene 1 year limited Swift Extract 1 year limited Swift Provocell
Ultra-low Temperature Freezer	5 years limited 5 years on compressor

Note: The warranty periods may vary by country. Contact your local distributor for specific warranty details.

For international distributors, warranty period starts two months from the date the equipment is shipped from Esco facility. This allows shipping time so the warranty will go into effect at approximately the same time the equipment is delivered to the user. The warranty protection extends to any subsequent owner during the warranty period. Distributors who stock Esco equipment are allowed an additional four months for delivery and installation, providing the product is registered with Esco. User can register their products online at www.escolifesciences.com/services/warranty-registration or complete the warranty registration form included with each product.

Policy updated on 1st January 2015 (This limited warranty policy applies to products purchased on and after 1st January 2015)

Introduction

1. Products Covered

Esco Cytoculture Cytotoxic Safety Cabinet			
Model	Electrical Rating	1.2 meters (4 feet)	1.8 meters (6 feet)
CYT – A Series	220-240 V AC, 50 Hz, 1Φ	CYT-4A1	CYT-6A1
	110-130 V AC, 60Hz, 1Φ	CYT-4A2	CYT-6A2
	220-240 V AC, 60Hz, 1Φ	CYT-4A3	CYT-6A3

2. Safety Warning

- Anyone working with, on or around this equipment should read this manual. Failure to read, understand and comply with the instructions given in this manual may result in damage to the unit, injury to operating personnel, and / or poor equipment performance.
- Any internal adjustment, modification or maintenance to this equipment must be undertaken by qualified service personnel.
- The use of any hazardous materials in this equipment must be monitored by an industrial hygienist, safety officer or some other suitably qualified individuals.
- Explosive or inflammable substances should never be used in the cabinet unless adequate risk assessment has been carried out.
- If chemical, radiological or other non-microbiological hazards are being used in the cabinet, additional protective measures should be taken based an adequate risk assessment.
- The toxic symbol (shown alongside) on the front panel of the cabinet indicates the presence of cytotoxic substances that pose a threat to human health.

- The cabinet is suitable for use with all risk group biological agents. However, the user is strongly encouraged to carry out risk assessment to ensure adequate safety features are in place when using the biological agents and carrying out any procedures with this cabinet.
- This cabinet is suitable to be used with cytotoxic substances because the V-bank filter (CYT A Series) underneath the work tray can be safely changed providing the blower is kept on. **NB:** Cytotoxic substances cannot be inactivated by conventional formaldehyde decontamination.
- Before you process, you should thoroughly understand the installation procedures and take note of the environmental / electrical requirements.
- In this manual, important safety related points will be marked with the symbol.

- If the equipment is used in a manner not specified by this manual, the protection provided by this equipment may be impaired.

3. Document Management

We recommend that you keep this manual, along with the factory test report close to the cabinet for easy reference by the cabinet operator and qualified maintenance personnel.

If you require replacements for any of the provided documentation (including factory test reports) you can request copies from Esco Customer Services*. Please provide the following information when making requests for replacement documents:

- Company (Organization) Name
- Product Brand and Model
- Product Serial Number
- Documents requested

** There may be a nominal charge for this service.*

4. Limitation of Liability

The disposal and / or emission of substances used in connection with this equipment may be governed by various local regulations. Familiarization and compliance with any such regulations are the sole responsibility of the users. Esco's liability is limited with respect to user compliance with such regulations.

5. European Union Directive on WEEE and RoHS

The European Union has issued two directives:

• **Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE)**

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked with the following symbol:

Esco sells products through distributors throughout Europe. Contact your local Esco distributor for recycling/disposal.

Recommended method of disposal is according to The Federal, State and Local Government regulations.

• **Directive 2011/65/EC on Restriction on the use of Hazardous Substances (RoHS)**

With respect to the directive on RoHS, please note that this cabinet falls under category 8 (medical devices) and category 9 (monitoring and control instruments) and is therefore exempted from requirement to comply with the provisions of this directive.

6. Symbols

Information in this manual may be prefaced with the following symbols. They are provided to help you identify important operational, safety, maintenance or conformance issues.

Electrical Hazard: Danger of electric shock

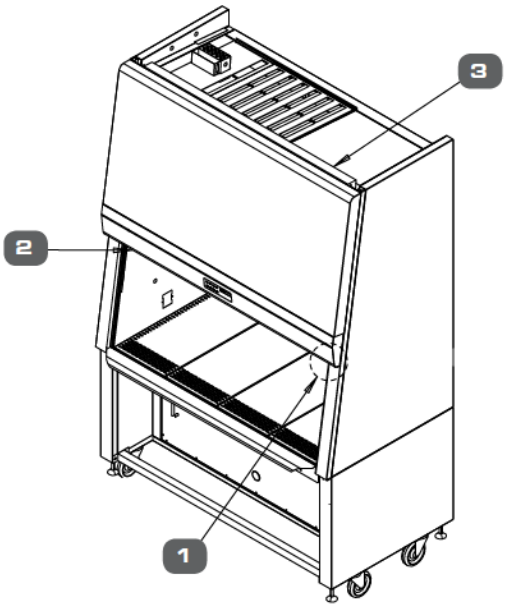
Turn Off and Disconnect From Main Supply Before Proceeding: Do not perform this operation while the unit is operational

The Toxic Symbol on the front of the cabinet indicates the presence of cytotoxic substances that pose a threat to human health

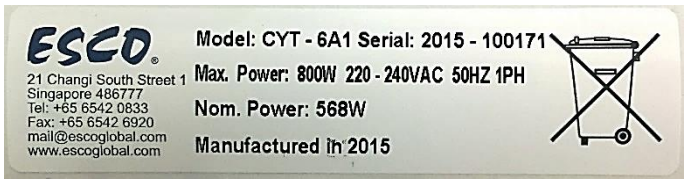
Approved Service Engineer Only: Operation to be performed only by approve engineers

Chapter 1 - Introduction

1.1. Unit Identification Labels



The first label will contain:



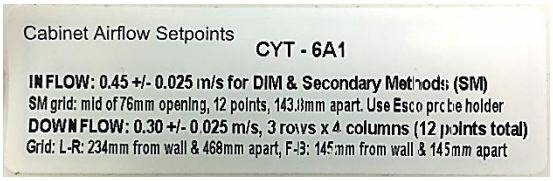
Model : The model of the unit

Serial : The serial number of the unit

Power : The maximum power consumption and the electrical requirement of the unit

Manufactured in : The month and year when the unit was manufactured

The second label will contain:



The model of the unit

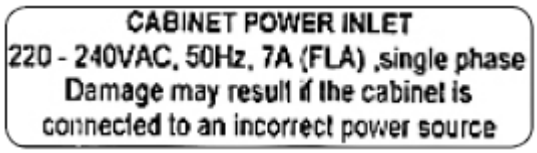
Inflow: The inflow setpoint for the particular unit. Inflow velocity can be measured by using Direct Inflow Measurement (DIM) or by using the Grid method. Information on measuring using the Grid can be found in the third line.

Downflow: The downflow setpoint for the particular unit and the total check points required. Downflow velocity can only be measured by using the Grid method as this method can also show the uniformity of the airflow. Information on measuring using the Grid can be found in the fifth line.

Note: For further information about inflow and downflow measurement, refer to chapter 1 of the Service section.

2

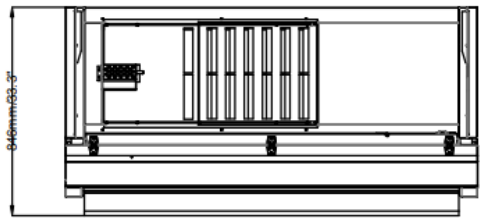
The third label will contain:

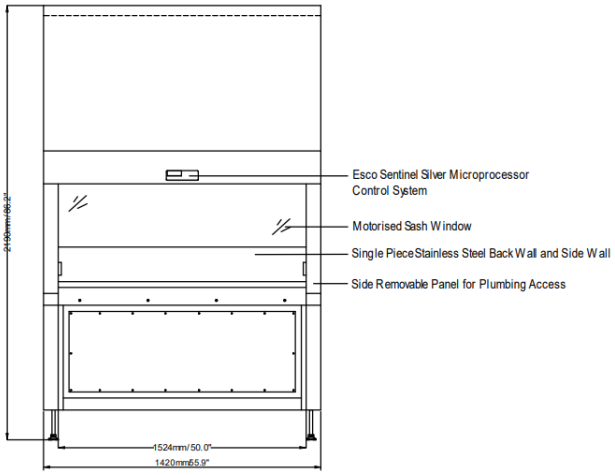


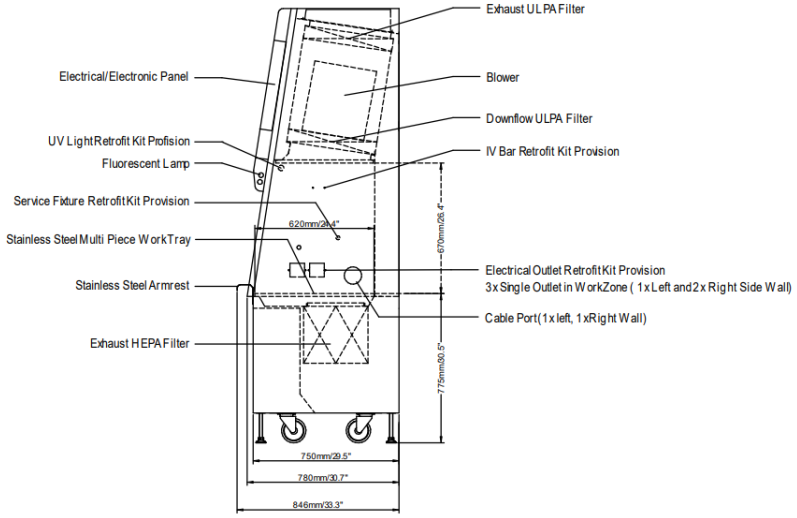
The third label is usually located next to the Cabinet power inlet. This label contains the electrical requirement needed to operate the unit.

Chapter 2 - Product Information

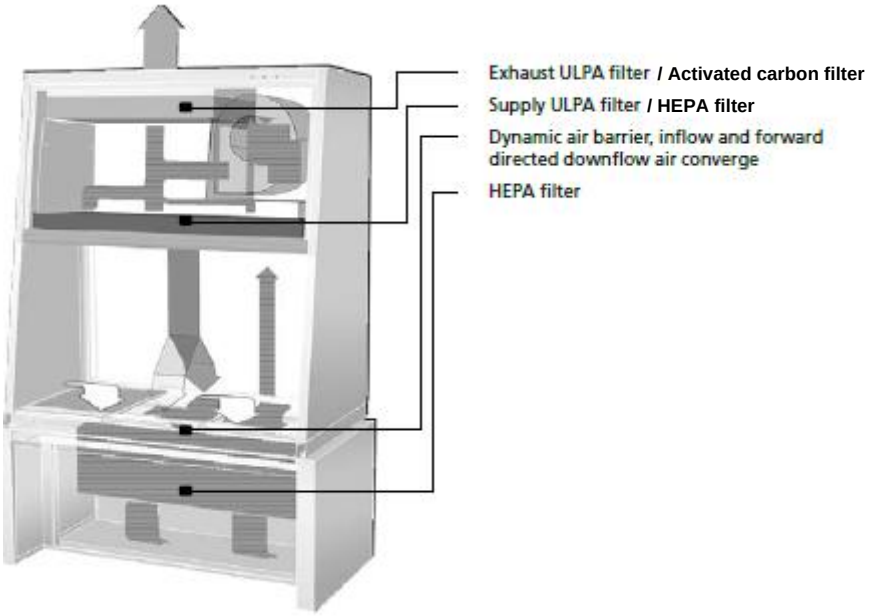
2.1. Quick View (CYT A Series)







2.2. Airflow Pattern



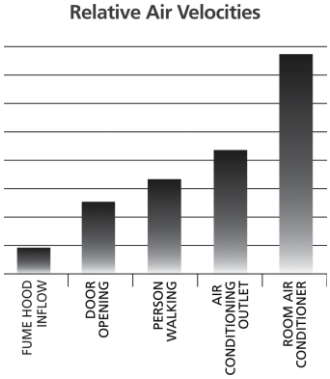
- Air enters the cabinet through perforations located along the front of the work zone before mixing with used downflow air in a common chamber below the work zone (this inflow air does not mix with the filtered downflow air in the cabinet's main chamber). The mixed air then passes through the HEPA filter located beneath the work zone.
- The HEPA filtered air then passes through internal ducting in the back wall of the cabinet to a common air plenum where 35% is exhausted through the ULPA exhaust filter (in CYT A Series) and 65% is forced evenly through the ULPA or HEPA supply filter. This sterilized air then passes through the main chamber as downflow air, flushing all contaminants from the work zone.
- At the work surface, the downflow air stream splits and enters the common air chamber beneath the work zone through perforations located at the front and back of the main chamber, from where the cycle is repeated.

Chapter 3 - Installation

3.1. General Requirement

3.1.1. Location Requirements

The cabinet needs to be sited in a location that does not compromise the performance of the unit.



As seen in the chart, your cabinet's internal airflow velocity is relatively low compared to the airflow disturbances potentially caused by opening a door, a person walking by or a direct exposure to an air-conditioning outlet. These external airflow disturbances can affect the containment of the cabinet. Therefore, the cabinet should be located as far away as possible from sources of airflow disturbance and in an orientation which optimally shields the cabinet's airflow from all external airflow disturbances. There should be adequate SOP in place to minimize events that will affect the performance of the cabinets.

The following requirements should be taken into account:

- If necessary, the arm rest and sash cover can be removed to reduce the overall depth of the cabinet. Detailed instructions on how to carry out this step can be obtained from your Esco Service Representative.
- Poor siting of a cabinet can adversely affect performance. Specialist engineer and safety personnel in your facility should be consulted on correct positioning of the cabinet prior to installation.
- Cabinets should never be sited in line with a doorway, a window that can be opened, or adjacent to a thoroughfare. Care should be taken to ensure that potential effect of room air diffusers, fans, extractors, vents, etc. on the cabinet are taken into account and any risk of airflow disturbance is appropriately treated (e.g. eliminated, mitigated) before installation.
- Room air supply diffusers should not be within 1.5 meter (5') of the front aperture. If there are large numbers of cabinets in a laboratory this recommendation may be difficult to comply with, but where diffusers have to be placed in close proximity to a safety cabinet, their discharge velocities will need to be low.
- The position of a cabinet should satisfy the spatial requirements (e.g. vision, lighting and convenience of access) of the operator and people working nearby.

3.1.1.1. Position Requirements (Based on NSF 49:2018 Annex E)

BSCs not connected to an exhaust system should have at least (12 inches [300 mm]) clearance from the filter face and any overhead obstructions when the cabinet is in its final operating position, to allow for testing of the Exhaust HEPA/ULPA filter. At least 12 inches (300 mm) clearance is required if the use of a thermal anemometer exhaust velocity measurement is needed when calculating cabinet inflow velocity.

All BSCs should be placed in a laboratory at a location that provides a minimum of:

- 6 inches (150 mm) from adjacent walls or columns.
- 6 inches (150 mm) between two BSCs.
- 6 inches (150 mm) space between both sides of the cabinet and 6 inches (150 mm) behind the BSC to allow for service operations.
- 40 inches (1020 mm) of open space in front of the BSC
- 60 inches (1520 mm) from opposing walls, bench tops and areas of occasional traffic.
- 20 inches (510 mm) between BSC and bench tops along a perpendicular wall.
- 100 inches (2540 mm) between two BSCs facing each other.

- 60 inches (1520 mm) from behind a doorway.
- 40 inches (1020 mm) from an adjacent doorway swing side.
- 6 inches (150 mm) from an adjacent doorway hinge side.

3.1.2. Preparing For Installation

3.1.2.1. Relocating the Cabinet

⚠ Normally the cabinets are rarely moved once they are in their ideal positions, but should there be a need to relocate or repackage the unit, here are some considerations:

- It is recommended that risk assessment is carried out before the cabinet is moved.
- Before moving the cabinet, remember to decontaminate the cabinet.
- Before moving the cabinet, remember to secure all moving parts (e.g. sash window).
- The cabinet is very heavy so please carry out adequate workplace safety assessment before moving the cabinet. The cabinet should not be moved with the aid of appropriate lifting equipment.

⚠ For repackaging:

- Remove the height booster at the bottom of the cabinet.
- Bolt the cabinet to the pallet.
- Strap the cabinet body down to the pallet.
- Repackage as necessary. If possible, use original packaging.
- When moving the cabinet, use material handling equipment and lift the pallet.

3.1.3. Environmental Requirements

- Indoor use only.
- Altitude of up to 2,000 meter (6,600 feet).
- Relative humidity between 20% – 90%
- Temperature between 18°C – 30°C (65°F – 86°F).
- Pollution Degree 2.0
  Pollution degree describes the amount of conductive pollutants present in an operating environment. In pollution degree 2.0, it is assumed that only non-conductive pollutants such as dust are present, except when occasional conductivity caused by condensation.

3.1.4. Exhaust Requirements

The exhaust filter area is susceptible to disruptive air currents or air drafts. A clearance of at least 30 cm (1') is recommended between the highest point of the cabinet and the ceiling. If the distance is less than 30 cm (1'), the airflow alarm system may need re-calibration. For proper exhaust filter leak scanning purposes (only for CYT A Series), a minimum clearance of 50 cm (1' 8'') is recommended.

⚠ Esco does not guarantee that this distance would be sufficient. It would have to be verified by your nearest Esco distributor or your service company.

3.1.5. Electrical Requirements

- The cabinet should be connected to its own dedicated power outlet(s).
- The power rating for each model is shown in below. Ensure that the outlet is rated accordingly.

Model	Power rating
CYT-_A1	220 - 240 V, AC, 50 Hz, 1Ø
CYT-_A2	110 - 130 V, AC, 60Hz, 1Ø
CYT-_A3	220 - 240 V, AC, 60Hz, 1Ø

- The power cable is located on the right-hand side of the cabinet and the cord is 2.5 m long. When preparing the installation site, try to ensure the outlet is located to the right of the cabinet for ease of access.
- The cabinet's maximum voltage fluctuation is ±2% of nominal voltage. Therefore, where voltage fluctuation is higher, suitable equipment such power stabilizer or UPS with appropriate feature is recommended.
- Surge protection and UPS are strongly recommended for better protection. Uninterruptible Power Supply (UPS) with power stabilization function could also be used to eliminate or minimize the voltage fluctuation seen by the cabinet. Where UPS is installed, it is recommended that the UPS is sized to enable the cabinet to operate for about 20 minutes to provide ample time for the personnel to react to the power failure.

3.1.6. Service Line Requirements

- All service lines should be installed by a suitably qualified and/or certified engineer, in accordance with all applicable local, state and government regulations.
- Service line attachments should be equipped with an emergency shut off valve that can be accessed quickly and with ease, should the need arise.
- Check whether there is a need to install pressure regulators to reduce the line pressure.
- Your cabinet can accommodate service fixtures on the left- or right-hand side of the cabinet. Make allowance for the positioning of service lines when planning the installation site to ensure ease of access to emergency shut off valves.

3.2. Optional Retrofit Kit

Full instructions for optional retrofit kits are included with the kit. Please refer to the manual that accompanies the kit for installation instructions. The following is a list of retrofit kits available for this unit, you may also want to visit www.escolifesciences.com for more information.

Accessories and Options	
Esco offers a variety of options and accessories to meet local applications. Contact Esco or your local sales representative for ordering information.	
Accessory / Option	**Description**
Electrical Outlets and Utility Fittings	• Electrical outlet • Petcock (air, gas, vacuum)
Cabinet accessories	• PVC armrest - Chemically treated, improves operator comfort, easy-to-clean. 711 mm (28") standard size.

Accessory / Option	Description
	• Germicidal UV lamp (If present) - Controlled by automatic UV lamp timer through Sentinel microprocessor control panel. - Emission of 253.7 nanometers for most efficient decontamination. – Lamp is positioned away from operator line-of-sight for safety and proper exposure to interior surfaces. Note: UV lamp intensity reduces over time and its effectiveness is subject to factors such as relative humidity in the cabinet, ambient air temperature and microbial species in the work zone.
	• Ergonomic footrest - Angled, helps maintain proper posture. - Adjustable height- Anti-skid coating, chemical resistant finish.
	• IV bar, with hooks - Stainless steel construction - Available for all standard Esco cabinets

3.3. Installation

3.3.1. Connecting the Electrical Supply

- Please refer to the serial label on the cabinet for the proper electrical rating to ensure the cabinet is connected to the correct electrical supply.
- All wiring should be done in accordance with the applicable National Electrical Code.
- Connect the supplied power cord to the input on the top of the cabinet. Make sure the cable connector is seated firmly in the socket.
- Ensure the mains electricity supply is switched off and then plug the unit into the wall socket. Do not start the unit up until all connections have been made and the post installation steps have been completed.

3.3.2. Connecting the Service Fixture(s)

- If you have purchased service fixtures for your cabinet these will either have been factory installed or provided in a package located inside the work tray when you unpacked the cabinet.
- If the fixtures have been provided for site installation there will be full instructions provided with them. Please refer to the instructions provided to install your retrofit kits.
- Connecting the cabinet to service lines must be performed by qualified personnel, in accordance with all applicable local, state and government regulations.
- Where applicable, each connection should be tested and certified by qualified personnel.
- Connections to service lines may be subject to the provision of safety device. There should always be an appropriate emergency shut off valve installed within easy reach of the cabinet operator.

3.3.3. Check Motorized Sash Mechanism

Please refer to section 6.1.3 to make sure that the sash mechanism operates properly.

3.3.4. Safety and Warning Labels on the Cabinet

Anyone using the cabinet should familiarize themselves with the various labels displayed in and on the cabinet. It is very important that users are familiar with the meanings of the labels before attempting to use the unit.

3.3.5. Preliminary Cleaning

Wipe the interior and exterior of the cabinet with water or a mild household detergent. The compatibility of the cleaning agent should be verified. Note: When the cabinet has been used for work, other suitable interior cleaning and disinfection method should be applied.

3.4. Performance Validation/Certification

After having installed the cabinet but before starting to use it, cabinet performance must be validated and certified to factory standards. It is recommended that this validation and certification be performed only by qualified personnel who is familiar with the methods and procedures for certifying biological safety cabinets.

The testing methods and equipment's needed for carrying out the tests are specified on the test report accompanying your cabinet.

3.4.1. Disclaimer

The performance and safety of all Esco cabinet are rigorously evaluated at our factory. Regular field certification is important to ensure factory standards are maintained.

3.4.2. References for Qualified Certifiers

North America

- NSF (http://www.nsf.org/Certified/Biosafety-Certifier/)
- Esco (http://escolifesciences.us/)
- IAFCA-member certifying company (http://www.iafca.com/listview)

UK, China, India, Middle East/North Africa, Malaysia, Singapore

- Esco offers field certification services directly. Contact local Esco office.

Other Countries

Contact Esco or local distributor.

Chapter 4 - Handling Cytotoxic Drugs

Based on USP General Chapter <800> Hazardous Drugs – Handling in Healthcare Settings, health care workers who work with or near cytotoxic drugs may be exposed to these agents in the air or on work surfaces, clothing or medical equipment. The health risk depends on the toxicity of the drugs, how the drugs can enter the body, and how the drugs are handled.

Health care workers should take the following steps to protect themselves from hazardous drugs:

4.1. General Precautions

- Read all information and material safety data sheets (MSDS) of the hazardous drugs you handle.
- Participate in all available trainings provided on the hazards of the drugs you handle, the equipment/tools used in the handling process, and the procedures you should use to prevent exposure.
- Be familiar with and able to recognize sources of exposure to hazardous drugs. Sources of exposure include:
  - All procedures involving hazardous drugs (including preparation, administration, and cleaning), and
  - All materials that come into contact with hazardous drugs (including work surfaces, equipment, personal protective equipment [PPE]).
- Prepare hazardous drugs only in the area that is devoted to that purpose alone and is restricted to authorized personnel.
- Prepare hazardous drugs in a correct containment primary engineering control (C-PEC) designed to protect workers and others from exposure and to protect all drugs that require sterile handling.
- For sterile hazardous drugs handling, observe proper aseptic technique at all times.

4.2. Personal Protective Equipment (PPE)

- Use disposable PPE and properly discard after use. Do not reuse disposable PPE. On the other hand, reusable PPE are not recommended for handling hazardous drugs, but if used, they must be decontaminated and cleaned after use.
- Use two pairs of powder-free, disposable, ASTM D6978-compliant chemotherapy gloves, with the outer one covering the gown cuff. When used for sterile hazardous drugs handling, the outer chemotherapy gloves must be sterile.
- Avoid skin contact by using a disposable gown made of polyethylene-coated polypropylene material (non-linting and non-absorbent). Make sure the gown has a closed front, long sleeves, and elastic or knit closed cuffs.
- Wear a face shield and goggles when splashes may occur and when adequate engineering controls (such as the sash or window on a ventilated cabinet) are not available.
- Wash hands with soap and water immediately before using personal protective clothing (such as disposable gloves and gowns) and after removing it.

4.3. Cleaning, Spill Management, and Waste Disposal

- All areas where hazardous drugs are handled and all reusable equipment and devices must be deactivated, decontaminated, and cleaned. Additionally, sterile compounding areas and devices must be subsequently disinfected.

Cleaning Step	Purpose	Agents
Deactivation	Render compound inert or inactive	As listed in the hazardous drug labeling or other agents which may incorporate Environmental Protection Agency (EPA)-registered oxidizers (e.g., peroxide formulations, sodium hypochlorite, etc.)

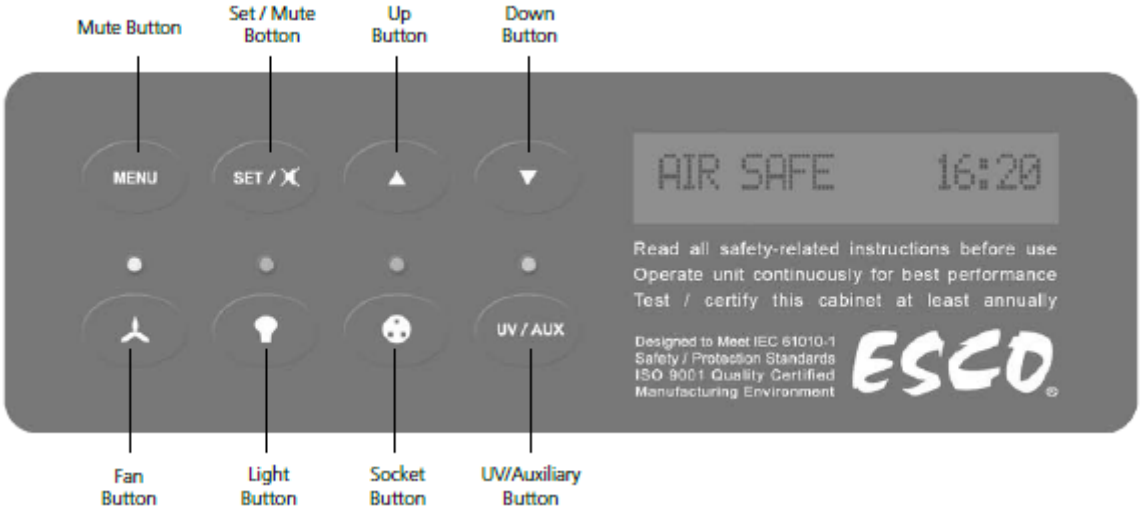
Cleaning Step	Purpose	Agents
Decontamination	Remove hazardous drug residue	Materials that have been validated to be effective for hazardous drug decontamination, or through other materials proven to be effective through testing, which may include alcohol, water, peroxide, or sodium hypochlorite
Cleaning	Remove organic and inorganic material	Germicidal detergent
Disinfection (for sterile manipulations)	Destroy microorganisms	EPA-registered disinfectant and/or sterile alcohol as appropriate for use

Source: USP <800> Hazardous Drugs—Handling in Healthcare Settings, Table 5 - Cleaning Steps.

- Clean up small spills of hazardous drugs immediately, using proper safety precautions and PPE.
- Clean up large spills of hazardous drugs with the help of an environmental services specialist.
- Spill Kits must be readily available at all times in all areas where hazardous drugs are handled.
- Handle hazardous wastes and contaminated materials separately from other trash.

Chapter 5 - Sentinel Control System

5.1. Sentinel Control System



1. Fan Button
   - Turns on and turn off the fan blower.

2. Light Button
   - Turns on and turn off the LED lamps.
   - Light goes on automatically when sash is at the operating position, READY state.
   - Light goes off automatically when sash is at SASH ALARM state.

3. Socket Button
   - Turns on and turn off the electrical socket (retrofit kit).
   - The maximum rating of all the outlets in the cabinet is 5 A. If overload, the fuse will blow.

4. UV Button
   - Turns on and turn off the UV lamp.
   - UV lamp can only be activated when the sash window is fully closed. Since the sash is capable of filtering UV rays, users are protected from the harmful UV radiation.

5. Up (▲) and Down (▼) Arrow Button
   - Move the menu options upwards and downwards.
   - Increase and decrease corresponding value inside one of the menu options.
   - Move the sash window upward and downward (for motorized sash cabinet).
   - Accessing the stopwatch and experiment timer function (for non-motorized sash cabinet).

6. Set or Mute Button
   - Proceed to the next step, level or sequence inside the menu options.
   - To mute the fully opened sash and air fail alarm sound (during normal mode).

7. Menu Button

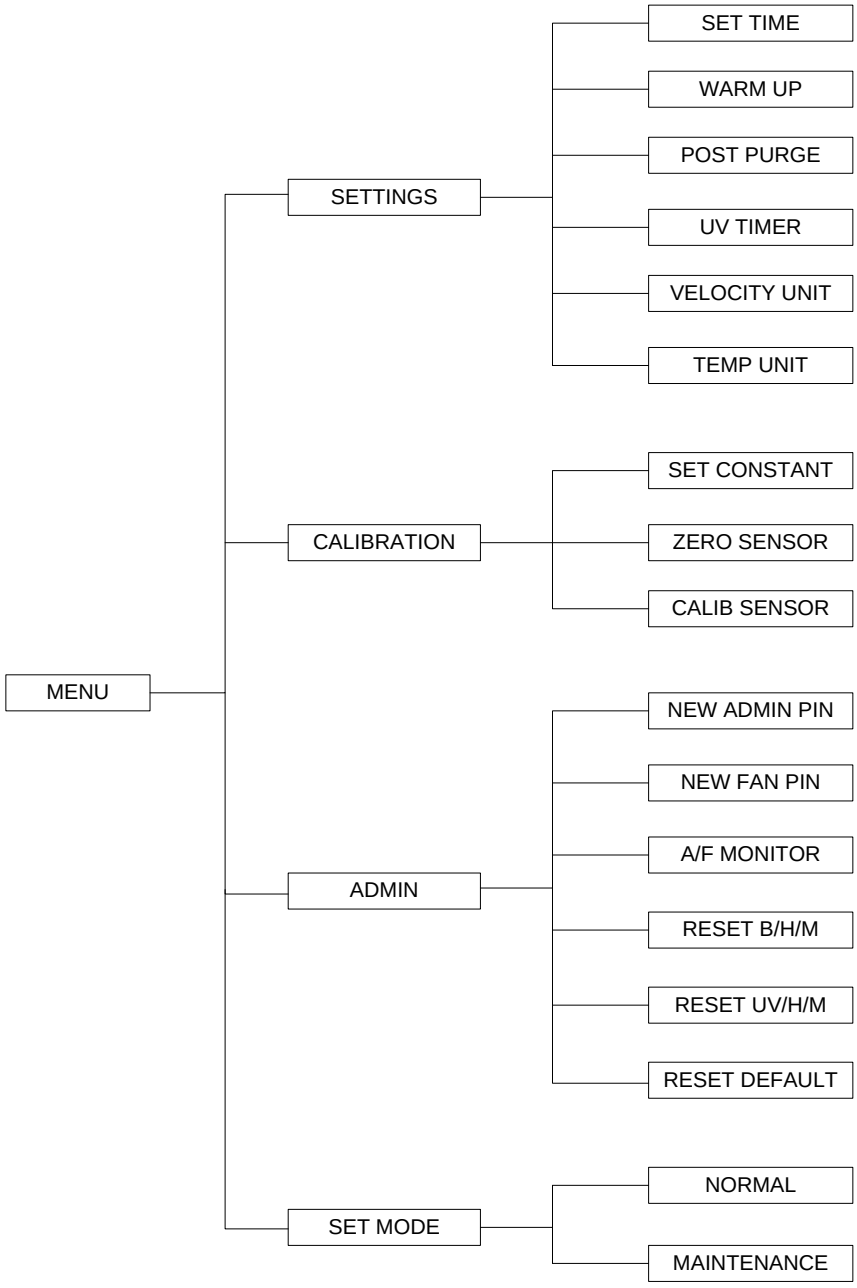
When you are entering menu options, the alarm will sound to indicate that the microprocessor is not monitoring the operation of the cabinet. No further warnings will be given.

   - To enter and exit from the menu options.

- To go back to the previous level of the menu options.
- To access maintenance mode from ERR.MSWITCH and AIRFAIL! error condition.

5.2. Menu Options

Please refer to the following diagram for complete reference to all menu options available.

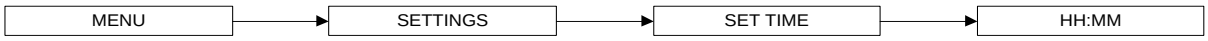


5.2.1. Settings

Users may use the settings menu function to customize the operation of the cabinet to meet specific application requirements. The settings menu can be entered using ADMIN PIN.

5.2.1.1. Set Clock (Time)

Users can set the time by increasing/decreasing the hour and minute values. The correct time will be maintained even after the unit is turned off.

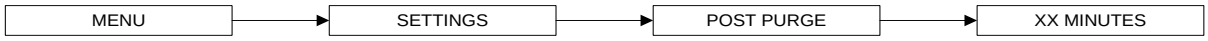


5.2.1.2. Warm Up Time

There will be a warm-up period, before the cabinet is fully functioning upon activation of the unit. This is to ensure that the sensors, the blower, and the control system are stabilized, as well as to ensure the work zone is purged of contaminants. The default setting is 3 minutes, and the user can set it between 3 to 15 minutes. (Note: Please note that WHO Laboratory Biosafety Manual (3rd edition) advocates 5 minutes purging time prior to start of work while US Biosafety in Microbiological and Biomedical Laboratories (5th edition) advocates 4 minutes).

5.2.1.3. Post Purge Time

After the user switches off the cabinet blowers, there will be a post-purge period, to ensure that all contaminants are purged from the work zone. The default setting is zero minute (disabled) and user can set from 0 up to 15 minutes. It is recommended that cabinet is purged for a minimum of 3 minutes after the work is complete. (Note: Please note that WHO Laboratory Biosafety Manual (3rd edition) advocates 5 minutes post purging time after work is completed while US Biosafety in Microbiological and Biomedical Laboratories (5th edition) advocates 4 minutes).

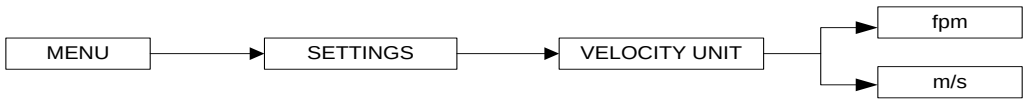


5.2.1.4. UV Timer (If UV present)

UV timer can be used to switch off the UV lamp automatically after a fixed period. The UV timer can be set up to 18 hours. By default, the timer is set to 60 minutes. Esco does not recommend leaving the UV lamp on for more than 60 minutes per decontamination cycle as it shortens the lifespan of the UV lamp. Unless the UV timer is activated, the lamp has to be switched off manually.

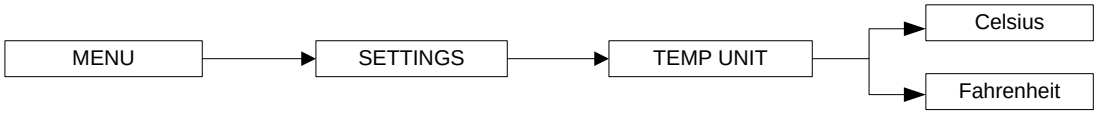
5.2.1.5. Velocity Unit

Using this option, the user can select the unit in which air velocity is measured and displayed. The user can choose between metric (m/s) and imperial (fpm) unit.



5.2.1.6. Temperature Unit Selection

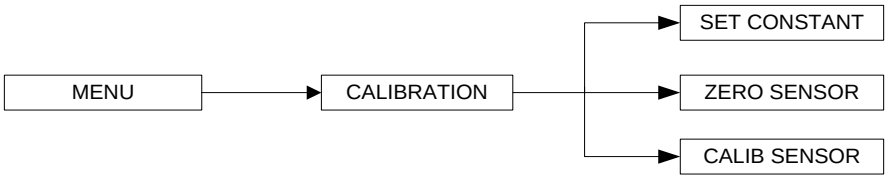
Using this option, the user can select the unit in which temperature is measured and display. The user can choose between Celsius and Fahrenheit. The exhaust temperature is displayed in the selected unit.



5.2.2. Calibration

The purpose of calibration is to ensure the accuracy of the airflow display and alarm (if present). This involves measuring airflow with reference instrumentation and establishing reference between airflow sensor(s) on the

cabinet to the standard reference. Calibration should only be carried out by qualified personnel. This section presents a brief overview of the calibration menu function. For more information, refer to test report.



5.2.2.1. Set Constant

Every sensor manufactured by Esco has a specific Sensor Constant which is used for temperature compensation by the temperature sensor.

5.2.2.2. Zero Sensor

This option is to let the controller record the specific sensor output voltage and correspond it to 0 m/s or 0 fpm.

5.2.2.3. Calib Sensor

This option allows proper calibration and operation of the airflow sensor alarm. There will be three points to be calibrated, namely inflow fail point, inflow nominal point, and downflow nominal point.

5.2.3. Admin

The admin menu allows you to change both FAN and ADMIN PIN. The reset blower, filter and UV hour meter (if present) functions are usually used after the blower, filter, or UV lamp is changed as they can easily give user the indication on when to maintain the cabinet. The reset default function will return the options in the settings menu to their factory settings.

5.2.3.1. New ADMIN PIN (default 0009)

ADMIN PIN restricts access to some of the more delicate menu functions, namely admin and field calibration, which should only be accessed by qualified personnel. User must enter four digits ADMIN PIN before accessing these menus.

ADMIN PIN can also be used to switch to maintenance mode from ERR.MSWITCH and AIRFAIL! error condition.

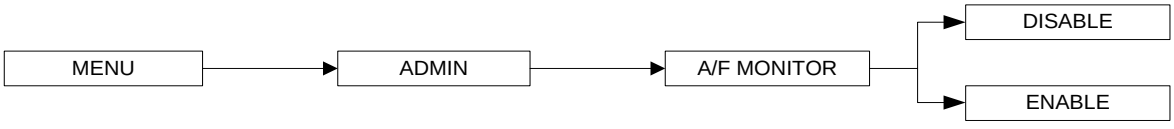
5.2.3.2. FAN PIN (default 0001)

FAN PIN restricts access to fan control. User must enter four-digit PIN before switching fan on or off. This feature prevents unauthorized personnel from accessing critical control sections. It will also prevent unauthorized shutdown of the cabinet when continuous operation is required. Fan PIN is also needed to disable the alarm when the sash is fully raised, and cleaning needs to be performed.

It is recommended that the Fan PIN be issued only to personnel authorized to use the cabinet. Setting the PIN to 0000 will disable this feature. When the FAN PIN is disabled, the cabinet can be turned on and off without requiring PIN.

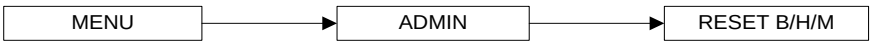
5.2.3.3. A/F Monitor

Whenever the air velocity falls below the failure point, the air fail alarm will be triggered. This option is used to enable/disable alarm. The alarm is enabled by default. When the Airflow Monitor is disabled, the warm up period is removed.



5.2.3.4. Reset Blower Hour Meter

This option is used to reset the blower hour meter. The blower hour meter indicates how long the blower has been in operation. Maximum counter is set at 9,999 hours. The counter value can be checked in the maintenance mode. The value can also provide some help in setting up maintenance schedule.



5.2.3.5. Reset UV Hour Meter

This option is used to reset the UV lamp hour meter. The UV lamp hour meter indicates how long the UV lamp has been in operation. Maximum counter is set at 2,000 hours. The counter value can be checked while in the diagnostic mode. Please reset the UV lamp hour meter after each UV lamp replacement.

5.2.3.6. Reset Default

This option is used to reset setting to. The features being reset are warm-up period (3 minutes), post-purge period (0 minute), UV timer (0 minute), velocity unit (m/s), temperature unit (Celsius), Admin PIN and Fan PIN. Please note that the calibration settings cannot be reset as it may cause the cabinet to operate in an unsafe manner. The hour meters cannot be reset either.

5.2.4. Setting the Mode

Cabinet has two working modes, the default normal mode which is used in a day to day activity, and maintenance mode.

5.2.4.1. Normal Mode

Every time the Cabinet is restarted, this mode will be activated by default. In this mode, all alarms and interlocks are enabled.

5.2.4.2. Maintenance Mode

Maintenance mode should only be accessed by qualified personnel during maintenance. In this mode, all alarms are disabled, and all interlocks are defeated.

5.3. Alarms and Warnings

Cabinet uses alarms to indicate that the condition inside the Cabinet is not safe for the operator, so check the LCD display to understand the cause of these alarms. The most common alarm is the SASH ALARM that indicates that the sash is neither at the normal operating height nor at fully closed position (UV mode) – this condition can easily be corrected by putting the sash at the appropriate operation position.

Another warning that should be acted upon is “AIR FAIL!” which indicates that there is airflow failure. The operator should check if there is any obstruction to the airflow and correct it if possible. However, if the problem continues, the operator should stop working as the Cabinet’s protection may have been compromised. Call service or Esco’s local distributor.

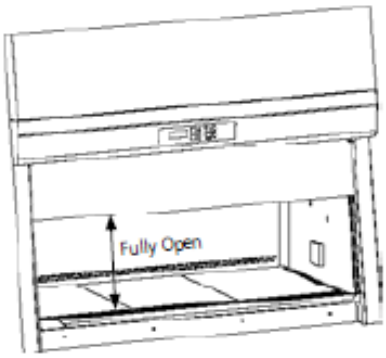
Other alarms that indicate a failure or an error in the Cabinet system:

- ERR.AIRFAIL will be displayed if the blower is turned off while there is an airflow failure.
- ERR.MSWITCH will be displayed if the microprocessor (controller) detects more than one magnetic switch activated at the same time, which is impossible, as the sash can only be at one position at one time. This indicates a failure in the sash detection system.
- ERR.CALIB will be displayed if the airflow velocity sensor is not yet calibrated.

Chapter 6 - Basic Cabinet Operation

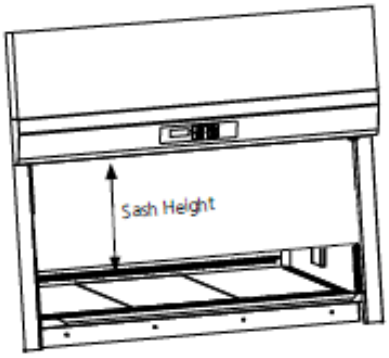
6.1. Sash Window Operation

6.1.1. Sash Window State



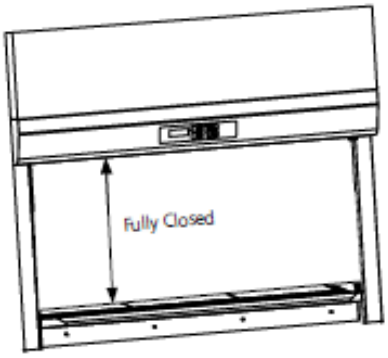
Sash is fully open

- ✓ Blower can be activated
- ✓ Fluorescent lights can be used
- × Unsafe working condition



Sash is in safe position

- ✓ Blower can be activated
- ✓ Fluorescent lights can be used
- ✓ Safe working condition



Sash is fully closed

- × Blower can't be activated
- × Fluorescent lights can't be used

6.1.2. Operating Motorized Sash Window

Lower and raise the Sash Window

When lowering or raising the sash window, ensure that the microscope part is not interfering with the sash window area.

Lower Sash from Fully Open Position (Push & Hold)

When the sash is fully open, pressing the down button and holding it will cause the sash to descend to the Safe Height setting and stop. If the LED lights are switched on as the sash moves away from the fully open position, they will switch off automatically. If you release the button before the sash has reached Safe Position / Safe Height, the lights will not be switched off. The LED lights switch on automatically when the sash reaches Safe Position.

Lower Sash from Safe Height Position (Push & Hold)

When the sash is at safe operating height, pressing the down button and holding it will cause the sash to descend to the fully closed position and stop. If the LED lights are switched on as the sash descends, they will switch off automatically as the sash leaves Safe Position. If you release the button before the sash has reached the fully closed position the lights will remain not operational.

Raise Sash from Fully Closed Position (One Touch)

When the sash is fully closed, pressing the up button will prompt the user to input the PIN (FAN or ADMIN PIN) to turn on the fan. If the correct PIN is correct, the fan will turn on and the sash will ascend to the Safe Height setting and stop.

Raise Sash from Safe Height Position (One Touch)

When the sash is in a safe operation position, pressing the up button will cause the sash to ascend to the fully open position and stop. If the LED lights are switched on, they switch off automatically as the sash leaves Safe Position. If the sash is stopped midway, the lights will remain not operational. The LED lights switch on when the sash reaches the fully open position.

6.1.3. Using Sash Window

- The sash window should be fully closed when the cabinet is not in use. This helps keep the work zone interior clean.
- The sash window should always be in the normal operating height at all times when the cabinet is in use. Even if the cabinet is left unattended, but the blower is on, the sash window should never be moved from the normal operating height, unless during loading or unloading of materials/apparatus into the cabinet.
- The alarm will be activated whenever the sash window is moved from the normal operating height.
- Whenever the sash window is moved to the correct height from a higher or lower position, the light will automatically be turned on as a signal to the user.
- The sash window may be opened to its maximum position for the purpose of loading/unloading of materials/apparatus into the cabinet. When the sash window is fully opened, the lights can be turned on to facilitate cleaning.
- The fan should be turned off when the sash window at fully closed position, to turned off the fan system will require the user input the password, if the password not correct and after 2-3 minutes then the sash window will be bring to the safe position to prevent the glass smashed becaus2e of the high pressure.

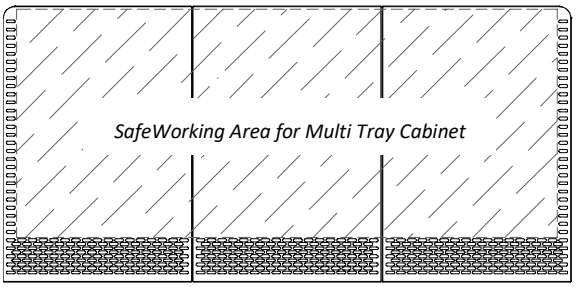
6.2. Starting and Shutting Down the Cabinet

When the cabinet is turned on, the cabinet will enter the warm-up period. In this period, the alarm will sound indicating that the cabinet is not safe to use.

When the cabinet is cabinet is turned off, the cabinet will enter the post-purge period. In this period, the LED lamp will turn off.

6.3. Working in the Cabinet

- Allow the cabinet to purge any contaminant by allowing the blower to operate for at least 3 minutes before and after using the cabinet (see Section 5.2.1.2 and 5.2.1.3 of this manual for more information).
- Wear appropriate personal protective equipment (PPE) determined by your risk assessment prior to working in cabinet.
- Adjust stool height to achieve a comfortable working position.
- Perform surface decontamination on the work area (work surface, back and side walls, UV lamp, electrical outlets, service fixtures and the inner surface of the sash window) before and after using the cabinet. When diffuser needs to be cleaned, damp cloth (not too wet) should be used to wipe, and user has to be careful not to cause the filter to be wetted. Where bleach is used, a second wiping with sterile water should be carried out to remove any residual chlorine that may corrode stainless steel surfaces.
- Perform surface decontamination on the surfaces of any materials, containers, or apparatus with appropriate disinfectant before entering or exiting the work area.
- Place the waste container (biohazard bag, pipette discard pans, etc.) inside the cabinet work area.
- Place all items and apparatus in the safe working area.



- Minimize room activities (personnel movements, closing and opening of doors, etc.) since these external airflow disturbances may adversely affect the cabinet's internal airflow, thereby possibly impairing the containment capabilities of the cabinet.

- Ensure that the sash is at normal operating height (READY state) before starting any experiment.
- Ensure the front and back air grilles are not obstructed by your arms or any other objects.
- Work as far back in the cabinet as possible - at least 150 mm (6 inches) behind the front air intake grille.
- Wait for around one minute after placing the hands into the cabinet prior to any manipulation.
- While working in the cabinet, move your hands slowly and in a controlled manner. Rapid movements may disrupt the air barrier, allowing contaminants to escape or enter the cabinet.
- The use of Bunsen burner inside the work zone is not recommended. However if the use of Bunsen burner is unavoidable, burner that is capable of being used on demand or enclosed electric microincinerator may be used but they must be placed towards the back of the work surface in the cabinet.

  ⚠ Use of Bunsen burners within Esco biosafety cabinets / cytotoxic safety cabinet is entirely at your own risk and Esco accepts no responsibility or liability for their use. Bunsen burner flames can disrupt the laminar airflow and will contribute to heat built up within the cabinet. However, if the use of a Bunsen burner is approved by a safety officer, it should be operated on the right side of the work zone. In Esco cabinets, the airflow sensor, when installed in the work zone, is mounted on the left side. Therefore, operating the burner on the right side would not affect the cabinet airflow monitoring system. All gas installations must be carried out in accordance with current national, state and local safety regulations by qualified personnel.
- Place aerosol-generating instruments as far back in the cabinet as possible and at least 150 mm (6 inches) from clean items/materials.
- Place air turbulence generating equipment such as centrifuges, blenders or sonicators towards the back of the cabinet. Stop other work while any of this equipment is in operation.
- It is recommended that post purge time is set to clear the work zone of contaminants after work in the cabinet is completed.

6.4. Working Ergonomics

On most occasions, you would most likely be operating the cabinet in sitting rather than standing posture although some cytotoxic safety cabinet users prefer standing position.

There are some obvious advantages of the sitting posture:

- The physiological energy cost and fatigue involved in sitting are relatively less.
- Sitting posture provides the body with a stable support.

However, sitting position has some drawbacks too:

- The working area available is fairly limited.
- There is a potential risk of being constrained in the same posture for a long time.
- Sitting posture is one of the most stressful postures for one's back.

Therefore, you should pay careful attention to the following guidelines in order to achieve comfortable and healthy working conditions during sitting:

- Always ensure that your legs have enough legroom.
- Keep your lower back comfortably supported by your chair. Adjust the chair or use a pillow behind your back whenever necessary.
- You should place your feet flat on the floor or on a footrest. Don't dangle your feet and compress your thighs.
- You should keep varying your sitting position throughout the day at regular intervals so that you are never in the same posture for too long.
- Observe the following precautions with respect to your eyes:
  - Give your eyes frequent breaks. Periodically look away from the work area and focus at a distant point.
  - Keep your glasses clean.
- Arrange the items/apparatus frequently used in your work in such a way that you can minimize the physical strain involved in handling them.
- Exercise regularly.

The cabinet noise emission has been tested and found to be in compliance with EN 12469, ISO 4871 and NSF/ANSI 49 which is important to ensure health and comfort for the operator.

Ergonomics accessories available with Esco include:

- Armrest padding.
- Lab chair.
- Footrest.

Please contact your local distributor or Esco for more information.

6.5. UV Lamps (If Present)

Shortwave UV (UVC) is considered as germicidal and virucidal. The UV lamp that Esco provides has a large portion of the spectrum in the UVC range. Unlike many other types of decontamination agent, UV light doesn't leave any residue. The decontamination action stops upon de-energizing of the lamp. However, the UVC spectrum does not penetrate well.

- UV light decontamination method may be used before and after working with susceptible organisms. However, it should not be the sole decontamination agent. Chemical decontamination agent should still be used.
- There should be minimum amount of material inside the cabinet's work area during the process of UV light decontamination. A direct interaction with UV light can degenerate plastic- or rubber-based material and can cause other hazards (e.g. generation of hazardous vapors).
- Before activating the UV lamp, the cabinet sash should be in fully closed position and the user should ensure that interlock is working properly. Avoid direct contact with skin and eyes as UV light is classified as a probable human carcinogen. Check the UV interlock regularly for correct operation.
- The UV timer feature should be used to easily control the decontamination period (Note: UV timer is disabled by default). Leaving the UV lamp on for over 60 minutes or even overnight is not recommended because it shortens the lifespan of the lamp. The UV lamps used in Esco Cabinet have a lifespan of 2,000 hours.
- The UV lamp should be cleaned of any dust and dirt weekly and changed annually to ensure its effectiveness. Ensure that the lamp is turned off when lamp cleaning and maintenance is carried out.
- Please note that the use of UV lamp in the cabinet has been explicitly discouraged in all major international standards and recommendations.

6.6. Decontamination and Disinfecting Agents

- For stainless steel surfaces, all common disinfectant agents except chlorine-based ones are suitable. Where chlorine-based agents are used, sterile water should be used to wipe down the surfaces following the application of the disinfectant agents.
- For powder coated surfaces, all common disinfectant agents are suitable. However, the cabinet has been specifically evaluated for use with the following:
    - 1N hydrochloric acid
    - 1N sodium hydroxide
    - 1% quaternary ammonium compound
    - 5% formaldehyde
    - 5,000 ppm hypochlorite
    - 2% iodophor
    - 5% phenol
    - 70% ethyl alcohol
- Adequate contact time should be observed for effective decontamination and the time required depends on the disinfectant agents, the concentration and the object of disinfection.
- Suggested general interior cleaning and disinfection procedures (does not apply to spills) are:
    - Spray cleaning cloth / tissue with 70% ethanol. This will reduce the aerosols generated from the area to be cleaned.
    - Wipe the interior to be cleaned with a slow circular motion from outer to inner (e.g. less contaminated area to more contaminated area).

- *Note: This is just a simplified cleaning and disinfection procedure. Choice of cleaning of disinfection procedures should be made through risk assessment. All facilities need to have adequate spill cleanup procedures.*

- There is no one disinfectant agent that works with all organisms. Therefore, user and the safety professionals should carry out risk assessment to ensure that appropriate disinfectant agent and validated decontamination procedures are used in decontaminating the cabinet.
- Please take careful consideration when removing the V bank filter (CYT A Series) in order to minimize personnel's exposure to cytotoxic compound. Risk assessment should be carried out to ensure adequate protection is provided during such work.

6.7. Gaseous Decontamination

Decontamination may frequently be carried out by means of formaldehyde fumigation or using other decontamination agents, such as chlorine dioxide or hydrogen peroxide. Decontamination process should only be carried out by qualified personnel.

In any of the following eventualities, the user should ensure that the cabinet has been properly decontaminated, keeping in mind the nature of the pathogens used:

- At the time of moving/relocating the cabinet.
- At the time of changing the type of work being carried out in the cabinet.
- Before accessing contaminated areas for servicing (e.g. when filter needs replacement).
- Periodically and as mandated by your risk assessment.

Chapter 7 - Service and Maintenance

7.1. Scheduled Maintenance

Proper and timely maintenance is crucial for trouble free functioning of any device and your Esco cabinet is no exception to this rule. We strongly recommend that you follow the maintenance schedule suggested hereunder in order to obtain optimal performance from your Esco cabinet.

No.	Description of Task to Perform	Maintenance to be carried out every					
		Day	Week	Month	Quarter	1 Year	2 Years
1	Surface decontaminate the work zone	√					
2	Cabinet power-up alarm verification	√					
3	Perform thorough surface decontamination on the drain pan		√				
4	Clean UV lamp (where present) of any dust and dirt		√				
5	Clean the exterior surfaces of the cabinet			√			
6	Clean the sash window			√			
7	Check all service fixtures (where present) for proper operation			√			
8	Inspect the cabinet for any physical abnormalities or malfunction				√		
9	Clean stubborn stains on stainless steel surfaces with MEK				√		
10	Recertification					√	
11	Check the cabinet's functionality					√	
12	Change UV Lamp (where present)					√	
13	Change the LED lamps						√

Cleaning the cabinet

- Clean the work surface and walls with appropriate disinfectant and soap water afterward.
- Clean the sash window with appropriate disinfectant and glass cleaner afterward.
- Use a damp cloth to clean the exterior surface of the cabinet, particularly on the front and top in order to remove dust that has accumulated there.
- Use sterile water to finish the cleaning and wash away any residue of disinfectant, soap-water solution, and glass cleaner.
- For removing stubborn stains or spots on the stainless-steel surface, make use of MEK (Methyl-Ethyl-Ketone). In such cases, make sure that you wash the steel surface immediately afterwards with sterile water and some liquid detergent. Use a polyurethane cloth or sponge for washing. Regular cleaning of the stainless-steel surface helps retain the attractive factory finish.
- Ensure that the chemicals used are compatible to one another.
- Use appropriate personal protective equipment (PPE) when carrying out the activity.

Test the audible and visual alarm

The simplest method by far would be to move the sash until the glass window is no longer in the sash ready or UV mode position.

Check the cabinet's functionality

- Check the cabinet's mechanical functionality (e.g. sash window – lubricate if necessary).
- Check the cabinet's electrical functionality (e.g. LED lamp – replace if necessary).
- Check the cabinet for any defect and if any, repair immediately.

Recertification

All cabinets must be re-certified annually by qualified engineer. See certification procedures attached to the factory test report.

7.2. Maintenance/Service Log

It is good practice (and in some cases regulatory requirement) to maintain a log of all maintenance work carried out on your cabinet.