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Esco Controlled Environment Laboratory and Cleanroom Equipment Solutions

NSF / ANSI 49 Biological Safety Cabinets • Animal Containment Workstations • Fume Hoods • Clean Benches

**Polymerase Chain Reaction
Cabinets**

User and Service Manual

DOMINIQUE DUTSCHER SAS

Thank you for purchasing this Esco Polymerase Chain Reaction Cabinet. 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.escoglobal.com, to complement this manual and help you enjoy many years of productive and safe use of your Esco products.



User And Service Manual

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Polymerase Chain Reaction Cabinets

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Version History

Version	Changes
1.0 (August 2009)	Original Print.
1.1 (January 2010)	Update - Sentinel Silver

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Warranty Terms and Conditions

Esco warrants that this equipment will perform according to the specifications for 1 year (for SCR) and 3 years (for PCR) from the date of purchase.

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 if proven to the satisfaction of Esco that these parts 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
 - Problems caused by 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 fluorescent / UV bulbs

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 utilise 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 www.escoglobal.com/warranty 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.

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Singapore: +65 6542 0833

Global Email Helpdesk: support@escoglobal.com

Visit <http://www.escoglobal.com/> to talk to a Live Support Representative

Distributors are encouraged to visit the Distributor Intranet for self-help materials.

Policy updated on 30th Jan 2007 (*This limited warranty policy does not apply to products purchased before 30th Jan 2007*).

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Introduction

1. Products Covered

This manual is applicable and specific to the following Esco products.

Electrical	Nominal Size		
	0.6 meters (2')	0.9 meters (3')	1.2 meters (4')
220-240V, AC, 50Hz, 1Ø	SCR-2A1	PCR-3A1	PCR-4A1
110-130V, AC, 60Hz, 1Ø	SCR-2A2	PCR-3A2	PCR-4A2
220-240V, AC, 60Hz, 1Ø	SCR-2A3	PCR-3A3	PCR-4A3

2. Safety Warning

- Anyone working with, on or around this equipment should read this manual. Failure to read, understand and follow the instructions given in this documentation 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 material in the cabinet must be monitored by an industrial hygienist, safety officer or some other suitably qualified individual.
- Explosive or inflammable substances should never be used in the cabinet unless a qualified safety professional has evaluated the risk involved.
- If chemical, radiological or other non-microbiological hazards are being used in the cabinet, additional protective measures should be taken. Besides that, the operation should be monitored by a suitably trained individual.
- Before you proceed, you should thoroughly understand the installation procedures and take note of the environmental/electrical requirements of the cabinet.
- In this manual, important safety related points will be marked with this symbol. 
- If the equipment is used in a manner not specified by this manual, the protection provided by this equipment may be impaired.

3. Limitation of Liability

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

4. European Union Directive on Weee and RoHS

The European Union has issued two directives:

- **Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE)**

The objective of the WEEE directive is to promote "...the reuse, recycling and other forms of recovery of such wastes (WEEE) so as to reduce the disposal of waste besides improving the environmental performance of all operators involved in the life cycle of electrical and electronic equipment, e.g. producers, distributors and consumers..." and hence this directive refers to the disposal of this cabinet within the EU. A "wheelie bin" sticker (shown alongside) has to be pasted on all products covered by this directive, indicating that at the time of disposing of the product, it should not be grouped together with general unsorted municipal waste. Instead, distributors of electrical and electronic equipment should be responsible for the collection and scrapping of the products they have sold. Please note that this cabinet has been classified as "fixed industrial equipment" and hence the WEEE directive is not applicable to its disposal. You may, at the time of disposing this cabinet, still contact your local Esco distributor who can arrange for collection and recycling of this cabinet for a reasonable fee.







- **Directive 2002/95/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 9 (*monitoring and control instruments*) and is therefore exempted from requirement to comply with the provisions of this directive.

5. 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
	Important Information: Read and understand before proceeding. Important safety related points will be marked with this symbol
	Approved Service Engineer Only: Operation to be performed only by approved engineer

Declaration of Conformity *

In accordance with EN 17050-1:2004



We,
based at **Esco Micro Pte Ltd**
21 Changi South Street 1
Singapore 486777
Tel: +65 65420833
Fax: +65 65426920

declare on our sole responsibility that the product:

Equipment : **Polymerase Chain Reaction Cabinets**
Model : **Streamline Polymerase Chain Reaction Cabinets (SCR-2A_)**

in accordance with the following directives:

• **2006/95/EEC** : **The Low Voltage Directive and its amending directives**
• **89/336/EEC** : **The Electromagnetic Compatibility Directive and its amending directives**

has been designed to comply with the requirements of the following Harmonized Standard:

• **Low Voltage** : **EN 61010-1 (2001)**
• **EMC** : **EN 61326-1 (2002) Class B**

More information may be obtained from Esco's authorized distributors located within the EU. A list of these parties and their necessary contact information is available on request from Esco.

A handwritten signature in black ink, appearing to read 'Lim Lay Yew', is written over a horizontal line.

Lim Lay Yew
Chief Executive Officer

*Applicable only to 220 - 240V, AC, 50 HZ cabinets

Declaration of Conformity *

In accordance with EN 17050-1:2004



We, **Esco Micro Pte Ltd**
based at 21 Changi South Street 1
Singapore 486777
Tel: +65 65420833
Fax: +65 65426920

declare on our sole responsibility that the product:

Equipment : **Polymerase Chain Reaction Cabinets**
Model : **Airstream Polymerase Chain Reaction Cabinets**
(PCR-3A_, PCR-4A_)

in accordance with the following directives:

• **2006/95/EEC** : **The Low Voltage Directive and its amending directives**
• **89/336/EEC** : **The Electromagnetic Compatibility Directive**
and its amending directives

has been designed to comply with the requirements of the following Harmonized Standard:

• **Low Voltage** : **EN 61010-1 (2001)**
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More information may be obtained from Esco's authorized distributors located within the EU. A list of these parties and their necessary contact information is available on request from Esco.

A handwritten signature in black ink, appearing to read 'Lim Lay Yew', is written over a faint, large watermark that says 'DOMINIQUE BUTSCHER S.p.A.'.

Lim Lay Yew
Chief Executive Officer

*Applicable only to 220 - 240V, AC, 50 HZ cabinets

USER SECTION

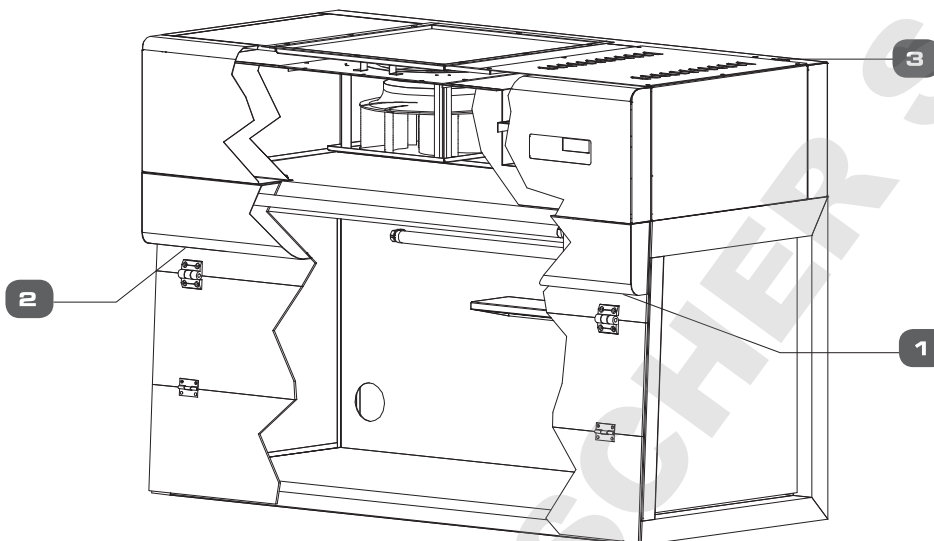
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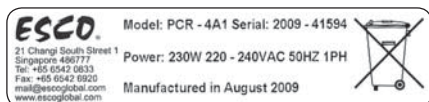
CHAPTER 1

Basic Product Information

1.1 Identification Label

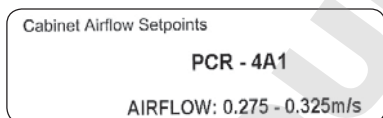


1. The first label will contain:



- 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.

2. The second label will contain:



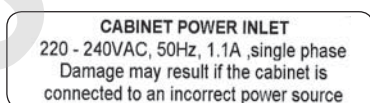
The model of the unit

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.

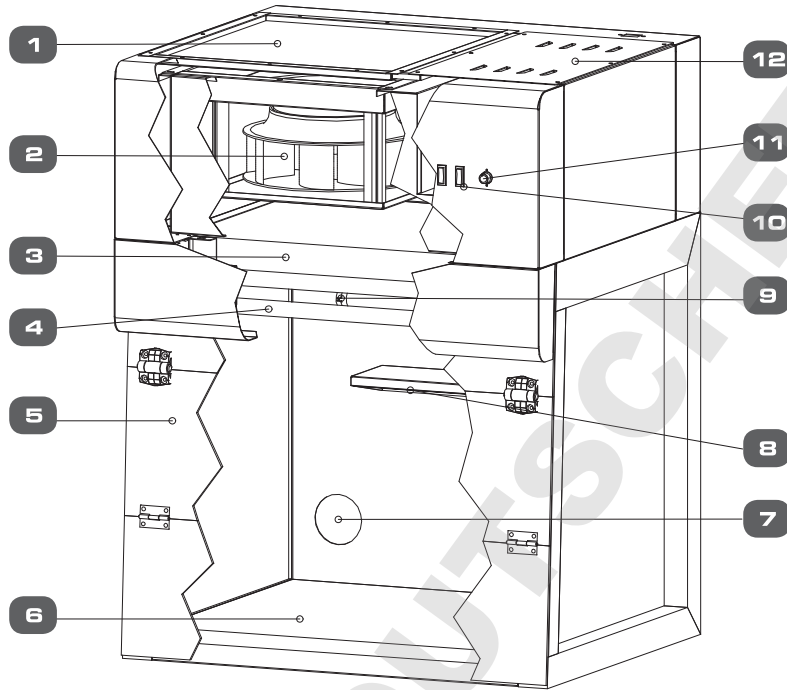
Note: For further information about inflow and downflow measurement, refer to chapter 1 of the Service section.

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



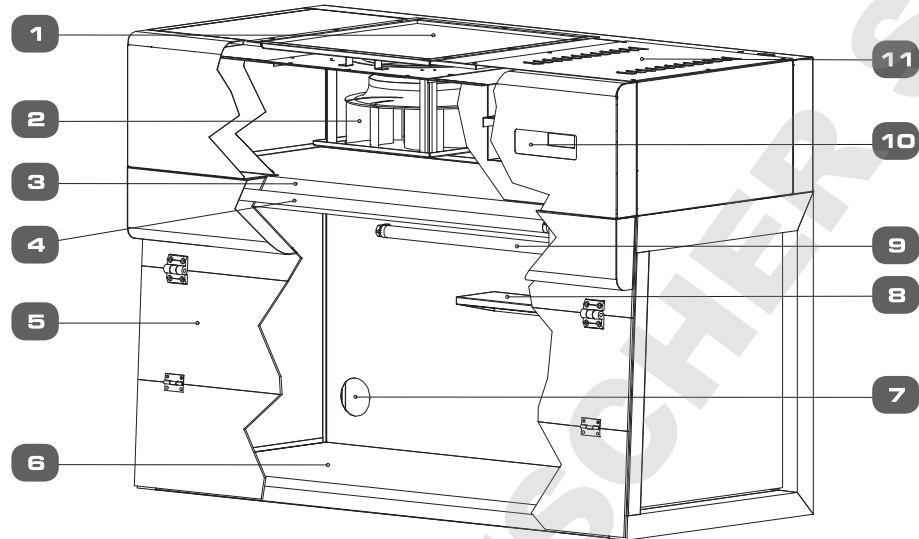
1.2 Quick View

1.2.1 SCR



1. Supply pre-filter
2. Supply blower
3. Supply ULPA filter
4. Fluorescent lamp
5. Acrylic front cover
6. Stainless steel worktop with curved front edge
7. Pass-through flap
8. Perforated powder-coated shelf
9. UV lamp
10. Operating switches
11. UV timer
12. Electrical panel

1.2.2 PCR



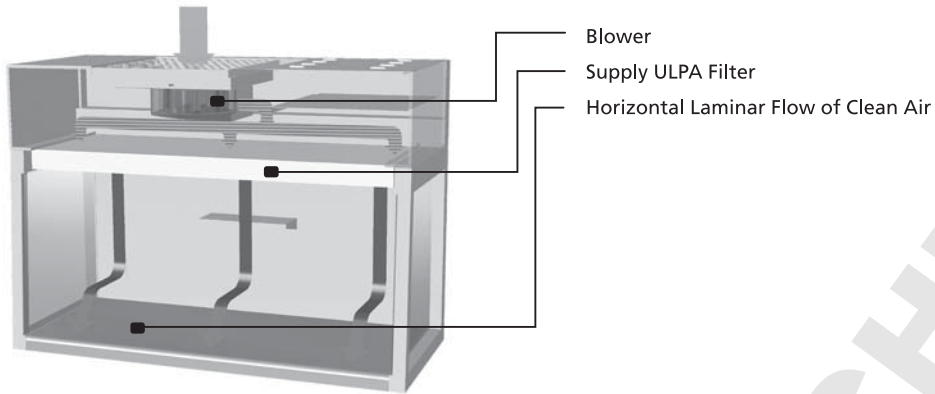
1. Supply pre-filter
2. Supply blower
3. Supply ULPA filter
4. Fluorescent lamp
5. Acrylic front cover
6. Stainless steel worktop with curved front edge
7. Pass-through flap
8. Perforated powder-coated shelf
9. UV lamp
10. Esco C-Sentinel
11. Electrical panel

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1.3 Airflow Pattern



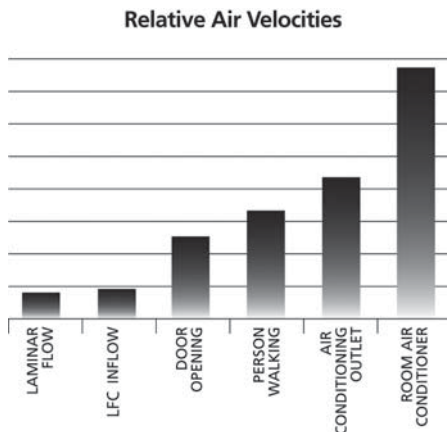
- During operation, room air is taken in from the top of the cabinet via a pre-filter with 85% arrestance, trapping larger particles and prolonging the life of the main filter.
- The air is then forced evenly through the HEPA filter resulting in a unidirectional stream of clean air that is projected vertically over the internal work zone. All airborne contaminants are flushed and diluted, resulting in a particulate-free work environment.
- The purified air then leaves the main work chamber across the open front of the cabinet.
- The average airflow velocity of:
 - 0.50-0.60 m/s (100-120 fpm) in SCR-2A model
 - 0.30 m/s (60 fpm) in PCR-3A and PCR-4A models ensures that cleanliness is maintained in the work zone.

CHAPTER 2 Installation

2.1 Pre-Requisites

2.1.1 Selecting the Installation Location

Location impacts the nature and extent of external airflow disturbances, which may affect performance of the cabinet when it is exposed to these disturbances.



As can be seen in the graph, your cabinet's internal airflow velocity is relatively small compared to the airflow disturbances potentially caused by the opening of a door, a person walking by or for that matter being exposed to an air-conditioning outlet. All these things can therefore affect the proper functioning of polymerase chain reaction cabinets, thereby impairing the protection offered by the cabinet.

When installing the cabinet, it 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. Please note that the cabinet should not be placed close to another cabinet.

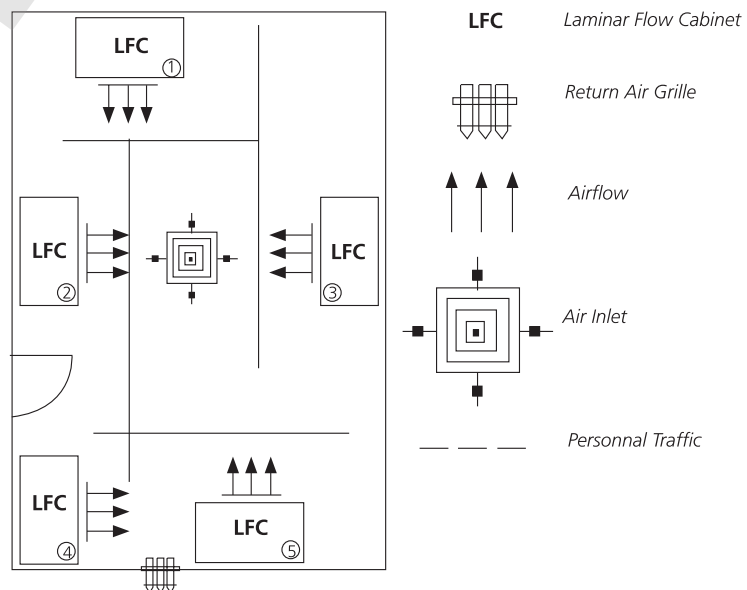
2.1.1.1 The following requirements should be taken into account:

- The location should be far away from any kind of heat source (*heaters, fan converters etc.*) for facilitating optimum operating conditions.
- A clearance of 183 cm (6 ft) in front of the cabinet is strongly advised in order to maintain proper airflow.
- There should be unobstructed access to the main power supply point.

2.1.1.2 Case Study: Choosing the Best Installation Location

Figure on the next page illustrates various possible influences that can be induced by a room's design and ventilation system on the cabinet's airflow. Please note that Figure on the next page does not depict any typical installation. In fact it is NOT recommended that so many cabinets be placed in a small room, or in close proximity to each other.

- LFC 1 is quite appropriately located with respect to avoidance of excessive air movements from surrounding areas.
- LFC 2 is too close to the doorway and its airflow could be influenced by the air inlet.
- The airflow of LFC 3 could also be influenced by the air inlet.
- LFC 4 is too close to the doorway.
- LFC 5 is suitably located provided that the adjacent return air grille does not influence cabinet airflow.



2.1.2 Preparing for Installation

2.1.2.1 Support Requirements

Esco provides a number of optional support stands:

- Support stand with casters
- Support stand with leveling feet
- Telescoping support stand with casters
- Telescoping support stand with leveling feet
- Hydraulic motorized adjustable support stand with casters

Esco support stand with leveling feet is recommended for safety. It is recommended that the installation of the support stand be carried out by qualified personnel (contact your Esco Distributor for assistance).

(ONLY IF LEVELERS ARE PRESENT) After installation of the clean bench on the support stand, using a level placed in the centre of the work tray, adjust the legs to achieve a level work surface. First level from left to right and then from front to back.



Two persons would be needed for assembling the support stand as it is quite heavy.

Should the cabinet be relocated after the initial installation, take all the necessary precautions as the cabinet is very heavy.

If the cabinet is not installed on Esco's optional support stand, Esco can not guarantee cabinet's resistance against tipping and hence the user would be solely responsible for ensuring that the cabinet is securely fastened to third party stand or table.

The use of non-leveling feet Esco support stand will nullify the third party certification (NSF or TÜV) that the cabinet may have, because only Esco leveling feet support stand was used during certification.

While installing the cabinet onto an existing work surface, ensure that the structure can safely support the combined weight of the cabinet and any related equipment. Some modifications to the work surface may be necessary.

The work surface should be smooth, nonporous and resistant to those disinfectants and chemicals, to which the cabinet is regularly exposed.

2.1.2.2 Electrical Requirements

The cabinet should be connected to its own dedicated power outlet(s).

The power rating for each model is shown in section 3.3 Technical Specification Summary Table in Product Specification Section. Ensure that the outlet is rated accordingly.

The power cable is located on the right hand side of the cabinet and the cord is 2.5m long. When preparing the installation site try to ensure the outlet is located to the right of the cabinet for ease of access.

2.1.3 Optional Retrofit Kits

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.escoglobal.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	<ul style="list-style-type: none"> • Electrical outlet, ground fault, North America • Electrical outlet, Europe/Worldwide • Petcock (air, gas, vacuum) - North America (American) style - Europe/Worldwide style. DIN12898, DIN12919, DIN 3537
Support Stands	• Fixed height, available 711 mm (28") or 864 mm (34")-With leveling feet- With casters
	• Hydraulic Motorized stand, hydraulic range from 711 mm to 960 mm (28" to 37.8")
	• Telescoping height stand for leveling feet, nominal range 660 mm to 960 mm (26" to 37.8")
	• Telescoping height stand for casters, nominal range 660 mm to 880 mm (26" to 34.6")
Cabinet Accessories	• PVC armrest
	• Ergonomic lab chair- Laboratory grade construction, meets Class 100 cleanliness; alcohol resistant PVC materials - Adjustable 395-490 mm (15.6"-19.3")
	• Germicidal UV Lamp
	• Ergonomic foot rest - Angled, helps maintain proper posture. - Adjustable height- Anti-skid coating, chemical resistant finish.
	• IV bar, with hooks
	• Transparent front cover for UV protection

2.2 Connecting the Cabinet

2.2.1 Connecting the Electrical Supply

Connect the supplied electrical cord to the input on the top of the clean bench. Make sure the cable connector is seated firmly in the socket.

2.2.2 Preliminary Cleaning

Wipe the interior and exterior of the cabinet with water or a mild household detergent.

2.3 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 a qualified technician who is familiar with the methods and procedures for certifying polymerase chain reaction cabinets.

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



Esco recommends that these tests be performed by a suitably qualified technician, familiar with both the methods and procedures for certification of your Esco product. Please refer to escoglobal.com to locate a local Esco Certified Partner.

2.3.1 Disclaimer

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

References for Qualified Certifiers

North America

- NSF (<http://www.nsf.org/Certified/Biosafety-Certifier/>)
- Esco (www.us.escoglobal.com)
- IAACA-member certifying company (www.iafca.com/listview)

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

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

Other Countries

- Contact Esco or local distributor

CHAPTER 3

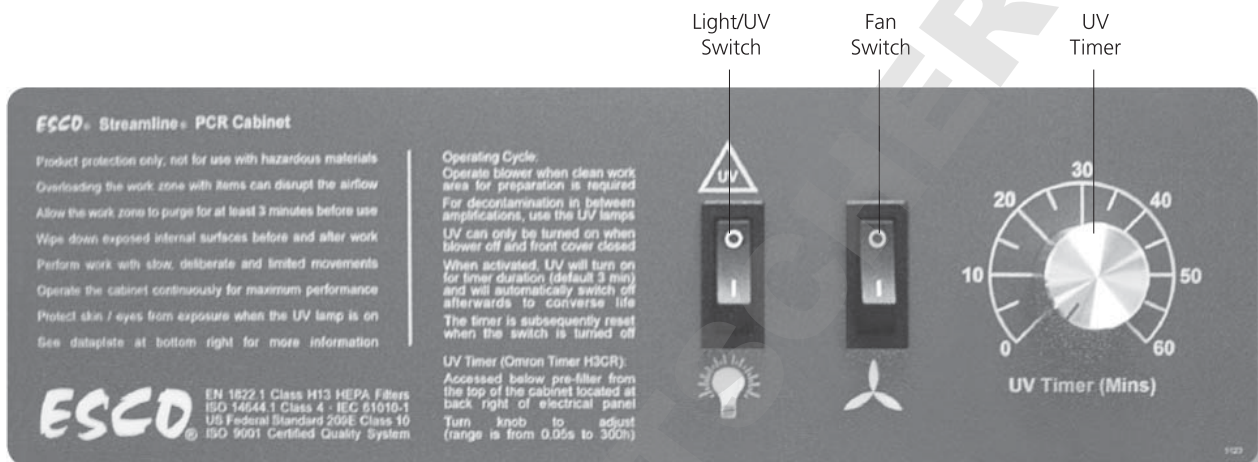
Operating Your Cabinet

Proper operating practices are essential to achieve effective performance and protection. A properly functioning, certified cabinet alone is not sufficient. This chapter provides information on operating procedures and recommended work practices to help users achieve the best performance and protection

3.1 Control System Overview

3.1.1 Streamline Series Control Panel

Note: This section only applies for SCR Cabinets



1. Light Switch

- Turns on and off the light.

2. UV Switch

- Turns on and off the UV lamp.
- UV lamp can only be activated when blower is off and safety cover closed. Since the front cover is capable of filtering UV rays, users are protected from the harmful UV rays.



- *Eyes and skin should not be exposed to direct UV light.*
- *UV light should not be relied upon as the sole decontaminating agent.*
- *Check the UV interlock regularly for correct operation.*

3. Fan Switch

- Turns on and off the fan.

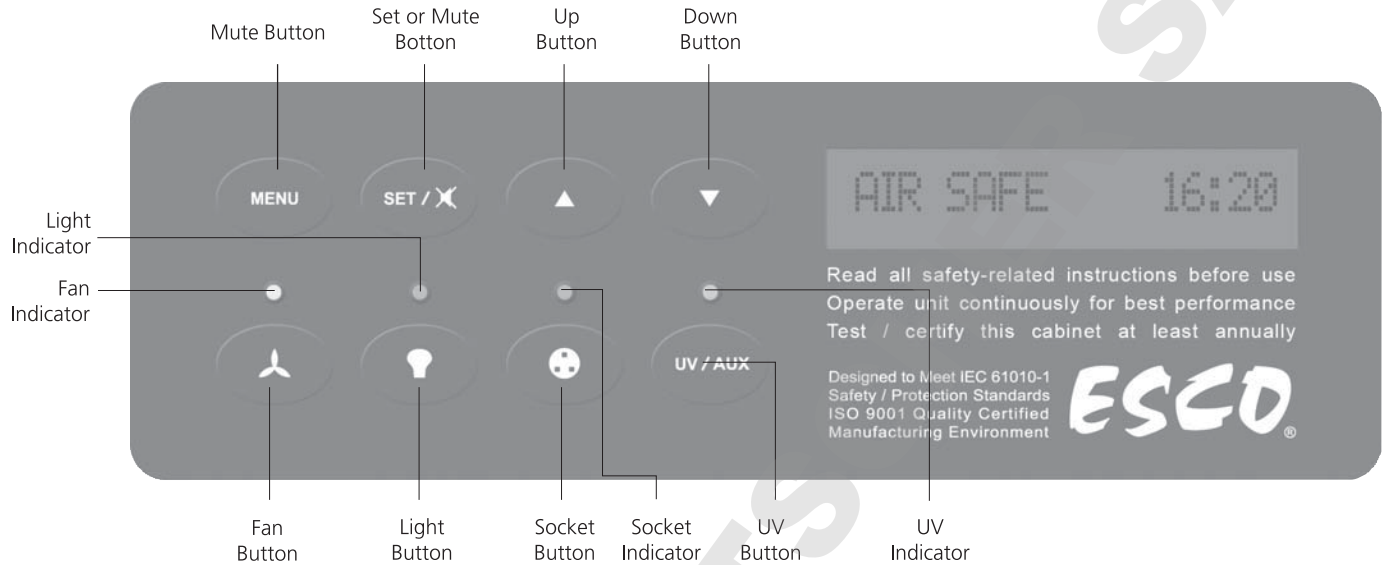
4. UV Timer

- Adjustable UV timer for UV lamp control giving you precise control of the decontamination cycle.

SAS

3.1.2 Sentinel™ Control System Overview

Note: This section only applies for PCR Cabinets



1. Fan Button

- Turns on and off the fan.

2. Light Button

- Turns on and off the light.
- Light turns off automatically when the front cover is closed and turns on automatically when the front cover is opened again (only in AUTO (SAFETY) mode)

3. Socket Button

- This feature is not available since there is no socket in this cabinet.

4. UV Button

- Turns on and off the UV lamp.
- UV lamp can only be activated when blower is off and safety cover closed. Since the front cover is capable of filtering UV rays, users are protected from the harmful UV rays.



- *Eyes and skin should not be exposed to direct UV light.*
- *UV light should not be relied upon as the sole decontaminating agent.*
- *Check the UV interlock regularly for correct operation.*

5. Up and Down Arrow Button

- Moves upwards and downwards the menu options.
- Increases and decreases corresponding value inside one of the menu options.
- Starts, stops and resets timer.
- Handheld stop clock is not allowed to be brought into the working space, as it might be a source contamination. For this purpose, TIMER is provided and functions as a stop clock only in READY state. It is displayed in HH:MM:SS format. Airflow velocity is monitored during timer mode.
- User can start by pressing UP arrow button and it will start counting. Pressing UP button again will stop the timer.
- User can then press UP button again to resume the timer. During this time, pressing DOWN button will take the user out of the timer mode, and "Timer Reset" message is displayed.

6. Set or Mute Button

- Chooses the menu or sub-menu currently displayed on the LCD screen.
- Proceeds to the next step or sequence inside one of the menu options.

7. Menu Button

- Enters and exits from the menu options.
- Goes back to the previous level of the menu options.

Some of the menu options allow the user to customize the cabinet for better working experience. *Please kindly refer to Section 3.6 for detailed explanations of each menu options.*



Before operating the clean bench, please ensure that you have set the Admin PIN (0009 the default) and Fan PIN (0001 by default)
The Admin PIN has higher priority and can be used to control the fan (overite the Fan PIN) too.
Please contact Esco should you forget your ADMIN PIN.

3.2 Starting the Cabinet

1. Prepare a written checklist of materials/apparatus necessary for immediate usage.
2. Turn off the UV light (if it is being used) as soon as you enter the work location.
3. Wash hands thoroughly using germicidal soap. Wear gloves for hand protection. Gloves should be pulled over the knitted wrists of the gown instead of wearing them inside. Double gloving may be necessary for higher risk work.
4. Put on a clean laboratory coat with long-sleeves. A solid front-back closing lab gown provides better protection to personal clothing than a traditional lab coat. If a higher degree of risk is involved then you should consider using a disposable gown.
5. Adjust the seating position for optimal operator comfort. It is recommended to use a height adjustable stool. Refer to section 3.4 on ergonomics for further information.
6. Thoroughly surface-decontaminate the work surface, side walls and back wall using 70% ethanol (or some other disinfectant depending on materials used in the cabinet). Surface-decontaminate the UV lamp as well. Do not use any disinfectant containing chlorine-based substances as this may cause corrosion of the stainless steel surfaces.
7. Minimize room activity (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.

3.3 Working in the Cabinet

1. Allow only essential items in the work zone. Items/instruments should not be placed between the filter and any area where the clean environment is needed. New items introduced into the work zone should be placed downstream of items already in the work zone for several minutes to allow contaminants to flush off.
2. Work in the cabinet in a slow and controlled manner. While putting items inside / removing items from the work zone, move your hands in and out of the work zone opening slowly and in a direction perpendicular to the plane of the work zone opening. Rapid movement of arms in a sweeping motion may disrupt the air barrier, thereby allowing contaminants to enter the cabinet.
3. Exercise particular care when placing equipment within the work space. Where possible, instruments should be placed on perforated platforms to allow air movement under as well as around the object.

4. Perform all work with the operator's hand or head downstream of the critical process points. Keep unnecessary movement within the work zone to a minimum.
5. Do not use Bunsen burner and aerosol-generating instruments whenever possible as they interfere with airflow.
6. In case of spills on the work surface, Esco's recommendations are:
 - Discontinue work process if possible
 - Inspect spill. If contents of spill are potentially harmful, wear appropriate PPE (gloves, gowns.etc)
 - Remove debris from spill and wipe up spills carefully to prevent further contamination
 - Broken containers and contaminated cleaning materials should be disposed of in appropriate disposal containers.
 - Wipe surfaces clean by applying appropriate disinfecting solution to cabinet surface. Most surface disinfectants require a specific contact time, depending on the microbiological agents used within the cabinet. After the specified contact time, wipe the excess disinfectant.
 - Leave the unit running for 5-30 minutes before continuing work to allow the system to purge itself.

3.3.1 Alarms and Warnings (only for PCR)

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 microswitch 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.

3.4 Working Ergonomics

On most occasions, you would most likely be operating the clean bench in sitting rather than standing posture. There are some obvious advantages of the sitting posture:

1. The physiological energy cost and fatigue involved in sitting are relatively less
2. 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:

1. Always ensure that your legs have enough legroom.
2. Keep the lower back comfortably supported by your chair. Adjust the chair or use a pillow behind your back whenever necessary.
3. You should place your feet flat on the floor or on a footrest. Don't dangle your feet and compress your thighs.
4. 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.
5. 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.
6. Arrange the items/apparatus frequently used in your work in such a way that you can minimize the physical strain involved in handling them.
7. Exercise regularly
8. Ergonomics accessories available with Esco include:
 - Armrest padding
 - Lab chair
 - Footrest

Please contact your local distributor or Esco for more information.

3.5 Cleaning and Shutting Down the Cabinet

1. As far as possible, it is recommended that the cabinet be operated continuously in order to achieve optimal containment and cleanliness. The cabinet will then remain in its initially clean condition. If, for any reasons, the unit is turned off, the face of the protective screen in cabinets should be cleaned- preferably with a small brush.
2. Surface-decontaminate all the items/apparatus using 70% Isopropyl Alcohol (IPA) before removing them from the cabinet. 100% IPA is not recommended because it will evaporate too fast before having sufficient contact time. It is recommended that the fan be left ON during this period.
3. Thoroughly wipe the work surface, side walls, inner back wall using water and some mild antibacterial detergent. Any disinfectant containing chlorine-based substances may corrode the steel used in the cabinet. So if such disinfectant is used, the residue must be immediately wiped off by using cloth and non-corroding disinfectant, such as 70% Isopropyl Alcohol (IPA).
4. Wipe off the detergent using water. Make sure that there are no traces of detergent left.
5. Wipe the work surface, side walls and back wall again with 70% Isopropyl Alcohol (IPA) or any other disinfecting agents listed on the next page.
6. Leave the blower on for 3 minutes in order to purge airborne contamination from the work zone.

7. Set the UV timer to 60 minutes or as the lab protocol dictates to decontaminate the interior of the cabinet. It is not recommended to leave the UV lamp ON overnight as it may shorten the lamp's lifespan. The UV lamps used in Esco cabinets have a lifespan of 8000 hours. By and large, the UV lamp should be replaced once a year in order to maintain its effectiveness.

Note: *The use of UV lamp in cabinets is not recommended because of several reasons. Firstly, UV lamp poses personal safety issues; exposure to UV radiation can cause erythema of skin and eye damage. Some UV lamps also contain mercury and breaking the lamp can result in undesirable exposure to this toxic compound. Secondly, UV causes performance degradation of the cabinet. UV lamp causes turbulence which disrupts the laminar/unidirectional nature of the air stream, which is critical to maintaining proper cabinet product/cross contamination performance. Lastly, UV lamp is ineffective on modern cabinets. UV lamps are ineffective as long as any surface contamination (dust particles etc.) is present as UV has limited penetrating power. Also, not all surfaces in the cabinet are exposed to UV radiation.*

8. Remove the laboratory coat and gloves and thoroughly wash your hands using germicidal soap.

3.5.1 Using UV Lamp

The UV light is a very effective germicide and virucide. Even at the minimum acceptable irradiance in a Cabinet – 40 $\mu\text{W}/\text{cm}^2$ (US Department of Health and Human Services et. al., 2000), it would only take 12.5 minutes to reach 30,000 $\mu\text{W}/\text{cm}^2$ (1 W = 1 J/sec), which has been listed as germicidal for spore forming organism.

Unlike many other type of decontamination agent, UV light doesn't leave any residue. The decontamination action stops upon de-energizing of the lamp.

However, due to the short wavelength, the UV light does not penetrate well. Thus UV light can only be used to effectively disinfect the work area of an empty Cabinet. For any container stored inside the Cabinet's work area, the UV radiation will only disinfect the outer surface of the material, leaving the inner surface and the content inside the material untouched.

- UV light decontamination method may be used before and after working with vegetative organisms and viruses. However, it should not be the sole decontamination agent; the use of chemical decontamination agent is still encouraged.
- Minimize the 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 hazard.
- Make sure that the Cabinet sash is in the fully closed position and the interlock is working properly before activating the UV lamp. Avoid direct contact with skin and eyes as UV light is classified as a probable human carcinogen.
- The UV lamp should be activated for around 60 minutes to work effectively. Use the UV timer feature to easily control the period of decontamination. UV timer is disabled by default. Please refer to section 3.6.1.3 for information on setting the UV timer.
- 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 8,000 hours.
- The UV lamp should be cleaned of any dust and dirt weekly and changed annually to ensure its effectiveness.
- The use of UV lamp in Cabinet has been explicitly discouraged in all major international standards and recommendations.

Disinfecting Agents

- For stainless steel surfaces, all common disinfecting agents except chlorine-based ones are suitable.
- For powder coated surfaces, all common disinfecting 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
- Depending on the contaminant involved at the time of operating the cabinet, there are various other types of disinfecting agents that may be used. Table on the next page outlines the effectiveness of various disinfecting agents against the different types of contaminants.

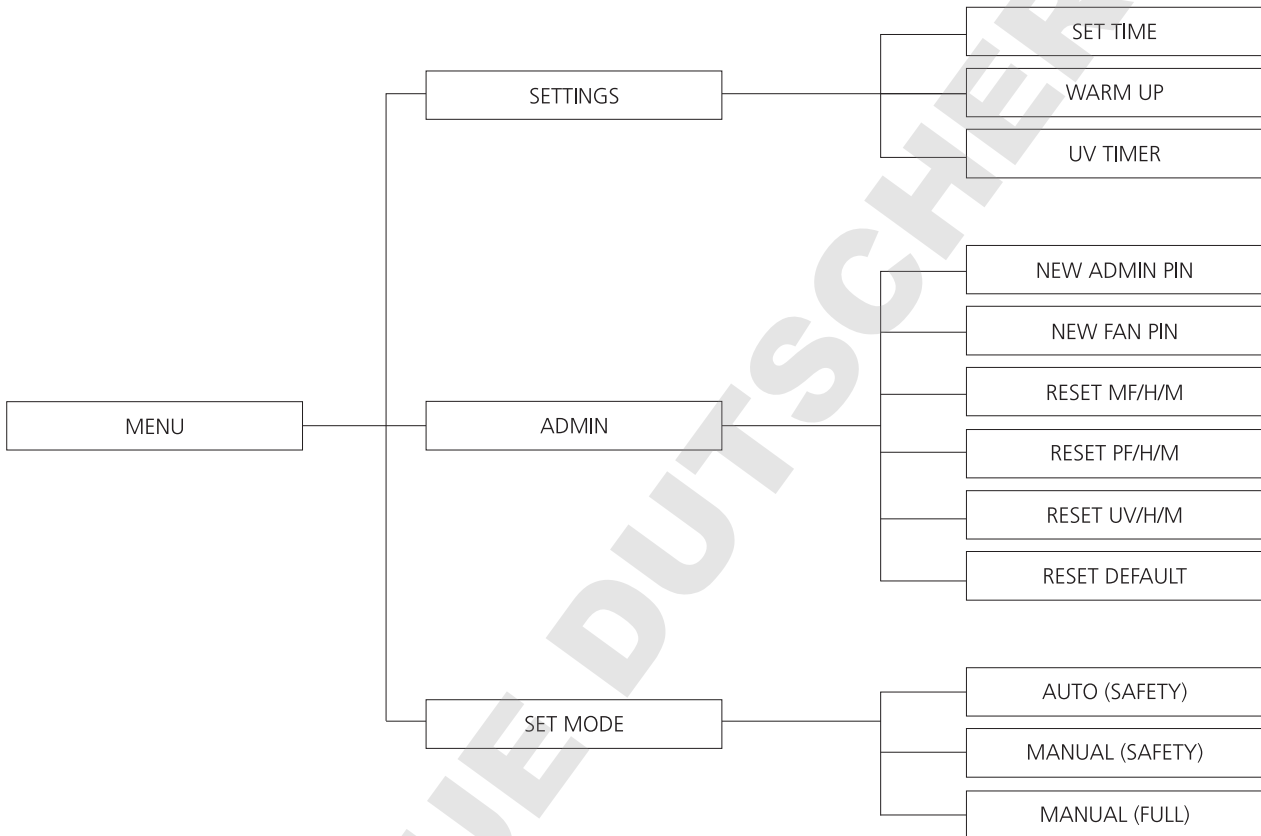
Decontaminant	Gluteraldehyde	Peroxide/Peracetic acid/Acetic acid	Chlorine Dioxide	Chlorine	Iodophor	Alcohol	Phenolic	Quaternary Ammonium Compounds
Classification	Sterilant	Sterilant	Sterilant	High Level	Intermediate	Intermediate	Intermediate	Low Level
Parameters for use:								
Concentration	2%	1%	1:5:1/100-1000 ppm	0.01-5%	0.5-2.5%	70-85%	0.2-3%	0.1-2%
Contact time (min.)	10-600	10-720	10-600	10-30	10-30	10-30	10-30	10-30
Stability > 1 week ⁽¹⁾	+		+		+	+	+	+
Agents:								
Bacterial Endospores	+	+	+	+/-				
Naked Viruses	+	+	+	+	+/- ⁽²⁾	+/- ⁽²⁾	+/- ⁽²⁾	
Mycobacterium	+	+	+	+	+	+	+	
Vegetative Bacteria	+	+	+	+	+	+	+	+
Enveloped Viruses	+	+	+	+	+	+	+	+
Characteristics:								
Inactivated by Organics		+		+	+	+	+/-	+
Residual	+	+	+	+/-	+		+	
Corrosive		+		+	+		+	
Flammable						+		
Skin Irritant	+	+	+	+	+		+	
Eye Irritant	+	+	+	+	+	+	+	
Respiratory Irritant	+	+	+	+	+	+	+/-	
Toxic	+	+	+	+	+	+	+	+
Use in Cabinets:								
Routine Surface Decon				+/-	+	+		+
Biohazardous Spill		+/-	+	+/-	+		+	+/-

(1) Protected from light and air

(2) Results vary depending on the virus

3.6 Menu Options

Please refer to the following diagram for complete reference to all menu options available. Press UP or DOWN button to move through the menu options. The user is strongly advised to exit from the menu options after making any changes in order to prevent unauthorized access to the menu.



3.6.1 Settings (Clock, Timer, and Units)

Press SET to enter the SETTINGS menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level.

3.6.1.1 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.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu	⇕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select SET TIME from the menu and press SET to set the time.	⇕ SET	→ SET TIME WARM UP UV TIMER
3	The Hour will flash, use the UP/DOWN buttons to select the correct hour and press SET to move on	⇕ SET	Set 24 Hour Clock HH:MM Format: 00:00
4	The Minutes will flash, use the UP/DOWN buttons to select the correct minutes and press SET to move on	⇕ SET	Set 24 Hour Clock HH:MM Format: 00:00
5	The display will show TIME SET for 2 seconds and then return to the SETTINGS menu.		Set 24 Hour Clock HH:MM Format: 00:00 TIME SET

3.6.1.2 Warm-Up Timer

There will be a period of warm-up, before the fan is fully functioning. This is to ensure that the sensors, the fan, and the control system are stabilized, as well as purging the work zone of contaminants. The default setting is 3 minutes and user can set it up to 15 minutes.

When airflow alarm is disabled, the warm up process only takes place during the installation (when the BSC is connected to the electrical inlet).

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu	⇕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select WARM UP from the menu and press SET to set the warm up time.	⇕ SET	→ SET TIME WARM UP UV TIMER
3	The screen will show the number of minutes for the warm up timer. Use the UP/DOWN buttons to select the value you want. Press SET to move on.	⇕ SET	XX Minutes
4	The display will show WARM UP SET for 2 seconds.		WARM UP SET

3.6.1.3 UV Timer

To switch off the UV lamp automatically after a fixed period, UV TIMER menu can be used. The UV TIMER can be set up to 18 hours. By default, the UV timer is set to 60 minutes. The most effective time for UV decontamination is around 60 minutes. Esco does not recommend that you leave the UV lamp on for more than 60 minutes or overnight as it shortens the lifespan of the UV lamp. If the UV timer is disabled, then the UV lamp must be switched off manually.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu	↕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select UV TIMER from the menu and press SET to set the UV timer.	↕ SET	SET TIME WARM UP → UV TIMER
3	The screen will show the number of minutes for the UV timer. Use the UP/DOWN buttons to select the value you want	↕ SET	15 Minutes
4	Press SET to move on. The display will show UV TIMER SET for 2 seconds and then return to the SETTINGS menu.	↕ SET	15 Minutes UV TIMER SET

3.6.2 Administrator Access and PIN

Press SET to enter the ADMIN menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level

3.6.2.1 New ADMIN PIN

ADMIN PIN restricts access to MENU functions, including service functions, like calibration. User must enter four digit PIN before accessing MENU. Admin PIN has higher priority and can be used to control the fan (override FanPIN).

The default ADMIN PIN is 0000 (disabled). Please follow the following steps to set a new ADMIN PIN:

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu	↕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select NEW ADMIN PIN from the menu and press SET to set a new administrator password.	↕ SET	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT
3	Using the UP/DOWN buttons, select the first digit of the PIN number and then press SET to move on	↕ SET	ADMIN PIN: XXXX Format: 1
4	Using the UP/DOWN buttons, select the second digit of the PIN number and then press SET to move on	↕ SET	ADMIN PIN: XXXX Format: 12
5	Using the UP/DOWN buttons, select the third digit of the PIN number and then press SET to move on	↕ SET	ADMIN PIN: XXXX Format: 123
6	Using the UP/DOWN buttons, select the last digit of the PIN number and then press SET to move on	↕ SET	ADMIN PIN: XXXX Format: 1234
7	The display will ask you to CONFIRM PIN. Press SET to confirm the ADMIN PIN.		ADMIN PIN: XXXX Format: 1234 CONFIRM PIN

3.6.2.2 New FAN PIN

FAN PIN restricts access to fan control. User must enter four-digit PIN before switching fan on or off. As such, it can restrict access to operating the cabinet by unauthorized personnel. It will also prevent unauthorized shutdown of the cabinet when continuous operation is required. Note that continuous operation is recommended for better safety.

It is recommended that the FAN PIN be issued only to personnel authorized to use the cabinet.

The default FAN PIN is 0000 (disabled). Please follow the following steps to set a new FAN PIN:

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu	↕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select NEW FAN PIN from the menu and press SET to set a new fan password.	↕ SET	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT
3	Using the UP/DOWN buttons, select the first digit of the PIN number and then press SET to move on	↕ SET	ADMIN PIN: XXXX Format: 1
4	Using the UP/DOWN buttons, select the second digit of the PIN number and then press SET to move on	↕ SET	ADMIN PIN: XXXX Format: 12
5	Using the UP/DOWN buttons, select the third digit of the PIN number and then press SET to move on	↕ SET	ADMIN PIN: XXXX Format: 123
6	Using the UP/DOWN buttons, select the last digit of the PIN number and then press SET to move on	↕ SET	ADMIN PIN: XXXX Format: 1234
7	The display will ask you to CONFIRM PIN. Press SET to confirm the FAN PIN.		ADMIN PIN: XXXX Format: 1234 CONFIRM PIN

3.6.2.3 Reset Main Filter Hour Meter

This option is used to reset the main filter hour meter. The main filter hour meter indicates how long the main filter has been in use. The message "PLS CHANGE M/F" will show on the LCD when the meter goes 3000 hours and beyond. The value can also provide some help in setting up maintenance schedule for filter changing. Please reset the hour meter after each main filter replacement.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu	↕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select RESET MF/H/M from the menu and press SET reset the main filter hour meter	↕ SET	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT
3	The screen prompts you with a warning to make sure that you understand this process.		READ MANUAL PRESS SET
4	Press the SET button to confirm that you want to reset the meter. If you do not want to reset the meter you can press MENU to exit to the previous screen.	SET or MENU	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT

3.6.2.4 Reset Prefilter Hour Meter

This option is used to reset the prefilter hour meter. The prefilter hour meter indicates how long the prefilter has been in use. The message "PLS CHANGE P/F" will show on the LCD when the meter goes 1000 hours and beyond. The value can also provide some help in setting up maintenance schedule for filter changing. Please reset the hour meter after each prefilter replacement.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu	↕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select RESET PF/H/M from the menu and press SET to reset the prefilter hour meter.	↕ SET	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT
3	The screen prompts you with a warning to make sure that you understand this process.		READ MANUAL PRESS SET
4	Press the SET button to confirm that you want to reset the meter. If you do not want to reset the meter you can press MENU to exit to the previous screen.	SET or MENU	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT

3.6.2.5 Reset UV Hour Meter

This option is used to reset the UV hour meter. The UV hour meter indicates how long the UV lamp has been used. The message "PLS CHANGE UV" will show on the LCD when the meter goes 1000 hours and beyond. The value can also provide some help in setting up maintenance schedule for filter changing. Please reset the hour meter after each UV lamp replacement.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu	↕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select RESET UV/H/M from the menu and press SET to reset the UV hour meter.	↕ SET	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT
3	The screen prompts you with a warning to make sure that you understand this process.		→ READ MANUAL PRESS SET
4	Press the SET button to confirm that you want to reset the meter. If you do not want to reset the meter you can press MENU to exit to the previous screen.	SET or MENU	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT

3.6.2.6 Reset Default

User can reset the default setting by choosing this option. The features being reset are warm-up period (3 minutes), UV timer (60 minute), Admin. PIN (0009), Fan PIN (0001) and operation mode (AUTO(SAFETY)mode).

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.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu	↕ SET	→ SETTINGS ADMIN SET MODE
2	Using the UP/DOWN buttons, select RESET DEFAULT from the menu and press SET to reset values to their default values	↕ SET	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT
3	The screen prompts you with a warning to make sure that you understand this process.		→ READ MANUAL PRESS SET
4	Press the SET button to confirm that you want to reset the values to their defaults. If you do not want to reset the values you can press MENU to exit to the previous screen.	SET or MENU	→ NEW ADMIN PIN NEW FAN PIN RESET MF/H/M RESET PF/H/M RESET UV/H/M RESET DEFAULT

3.6.3 Setting the Mode

Press SET to enter the SET MODE menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level.

Note: *Interlock = Switch function disabled at given window state.*

3.6.3.1 Auto (Safety) Mode

This is the default operation mode. Every time the cabinet is restarted, this mode will be activated by default.

In this mode, the UV light is switched off automatically, and interlocked when the hinged window is open at any position to prevent accidental UV exposure. Also, light and fan will be automatically switched on when window is open. Users may then control at will, the light and fan using the membrane control panel.

When users close the window, the UV light will then be un-interlocked, switched on automatically. Fan and light controls will be interlocked.

3.6.3.2 Manual (Safety) Mode

In this mode, the UV light is also switched off automatically, and interlocked when the hinged window is open at any position to prevent accidental UV exposure. Users may then control at will, the light and fan using the membrane control panel- the lights and fan will not switch on when the hinged window is opened.

When users close the window, the UV light will be un-interlocked. Users may then activate the UV light at will; the fan and light controls will be interlocked now.

3.6.3.3 Manual (Full) Mode



This mode should only be used during maintenance by qualified personnel

The Manual(Full) mode can be used for some of the following purposes:

1. Performance validation.
2. Filter scanning.
3. Checking of input / output diagnostics.

In this mode, the usual interlock safety routines are disabled. Users may switch on and off the fan, lights, and UV at will.

CHAPTER 4

Maintaining Your Cabinet

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.

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. Clean the exterior surfaces of the cabinet			✓			
3. Check all service fixtures (<i>where present</i>) for proper operation			✓			
4. Replace Pre-filter				✓		
5. Inspect the clean bench for any physical abnormalities or malfunction				✓		
6. Clean up stainless steel surfaces with MEK				✓		
7. Re-certification					✓	
8. Change UV Lamp (<i>where present</i>)					✓	
9. Change the fluorescent lamps						✓

1. Surface decontaminate the work zone

Thoroughly wipe the work surface, side walls, inner back walls and all other surfaces in the interior of the cabinet using a disinfectant appropriate for the work being conducted in your lab. If using a commercial preparation, it is helpful to follow up your wipe with a 70% ethanol rinse. Ethanol can help the disinfectant to evaporate cleanly.

Do not use any disinfectant containing chlorine-based substances as it may corrode the steel used in the cabinet resulting in irreparable damage to the cabinet's structure. Surface decontamination should be carried out for the UV lights and electrical outlet as well. While cleaning the interior of the cabinet, make sure that no part of your body except your hands go inside the cabinet. Please refer to the user section for details of appropriate disinfecting agents.

2. Clean the exterior surfaces of the cabinet

Using a damp cloth, clean the exterior surfaces of the cabinet, particularly the front and top of the cabinet in order to remove the dust accumulated there.

3. Check all service fixtures (where present) for proper operation

Observe local, state and national regulations as to when you need to get your service lines and fixtures certified.

4. Replace pre-filter

Replace the pre-filter quarterly. Pre-filter traps larger particles, prolonging the life of the main filter.

5. Inspect the clean bench for any physical abnormalities or malfunction

Check both fluorescent tubes (and UV light if present) to ensure that they are functioning properly and replace the bulbs if necessary.

6. Clean up Stainless Steel Surfaces with MEK

For removing stubborn stains or spots on the stainless steel surfaces, make use of MEK (Methyl-Ethyl-Ketone). In such cases, make sure that you wash the steel surface immediately afterwards with clean water and some liquid detergent. Use a polyurethane cloth or sponge for washing. Regularly cleaning the stainless steel surface can help you retain the attractive factory finish.

7. Re-certification

All clean benches must be re-certified annually by a certified engineer. The engineer will test airflow velocities, airflow patterns, the filter and perform a clean bench leak test to ensure that the clean bench is working properly.

8. Change UV lamp (*where present*)

To remove the old lamp, turn the tube 90 degrees and slide it out from the bracket. To insert the new lamp, slide it in to the socket and when fully inserted, turn the bulb 90 degrees to lock into position. Surface decontamination should be performed after changing the UV bulb.

9. Change the fluorescent lamps

- Before changing the fluorescent bulbs, ensure that the clean bench is powered down and disconnected from the electrical supply.
- Locate the bulbs.
- Remove the power clips at the ends of the bulbs by gently pulling whilst holding the bulb steady.
- Remove the bulbs from the mounting clips and replace with new ones.
- Replace the power clips on the ends of the new bulbs and ensure they are firmly seated.
- Reconnect the clean bench to the electrical supply and test the bulbs for proper operation.

Log Record

It is good practice (and in some cases regulatory requirement) to maintain a log of all maintenance work carried out on your clean bench. Esco has an example Maintenance Log available for download from the resources section of our website, www.escoglobal.com.

SERVICE SECTION

DOMINIQUE DUTSCHER SAS

CHAPTER 1

Re-Certification and Maintenance by Service Personnel

Esco products generally provide years of trouble-free operation however like all equipment they require maintenance and service.

Maintenance and service should be carried out by trained personnel. Esco offers training courses to equip service providers with the latest skills, information and tools to successfully maintain and service Esco products. For more information on the nearest training course, please contact Esco.

Service providers should familiarize themselves with the basic operating principles of products before working on them. Suitable references include information in the User Section of this Manual or brochures which may be downloaded from the Esco web site.

Polymerase Chain Reaction Cabinets generally require:

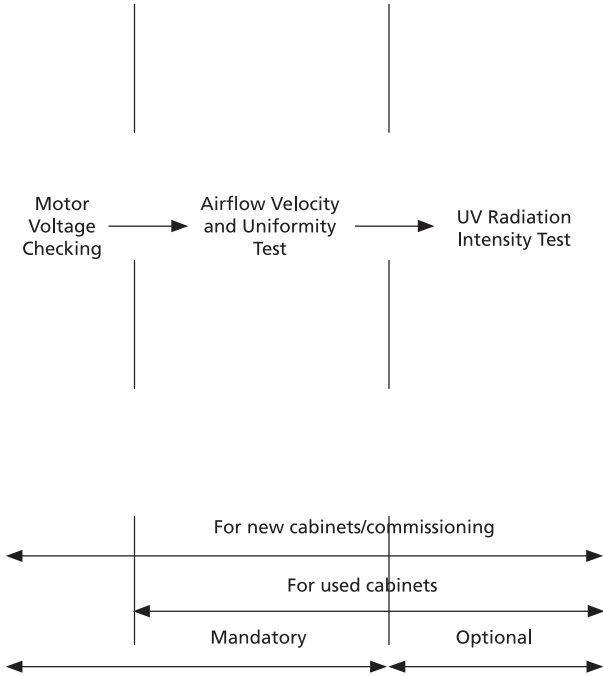
- Re-certification, when:
 - a. The clean bench is re-located
 - b. Clean bench performance is suspected
 - c. After filter or blower replacement
 - d. At least once a year

During recertification:

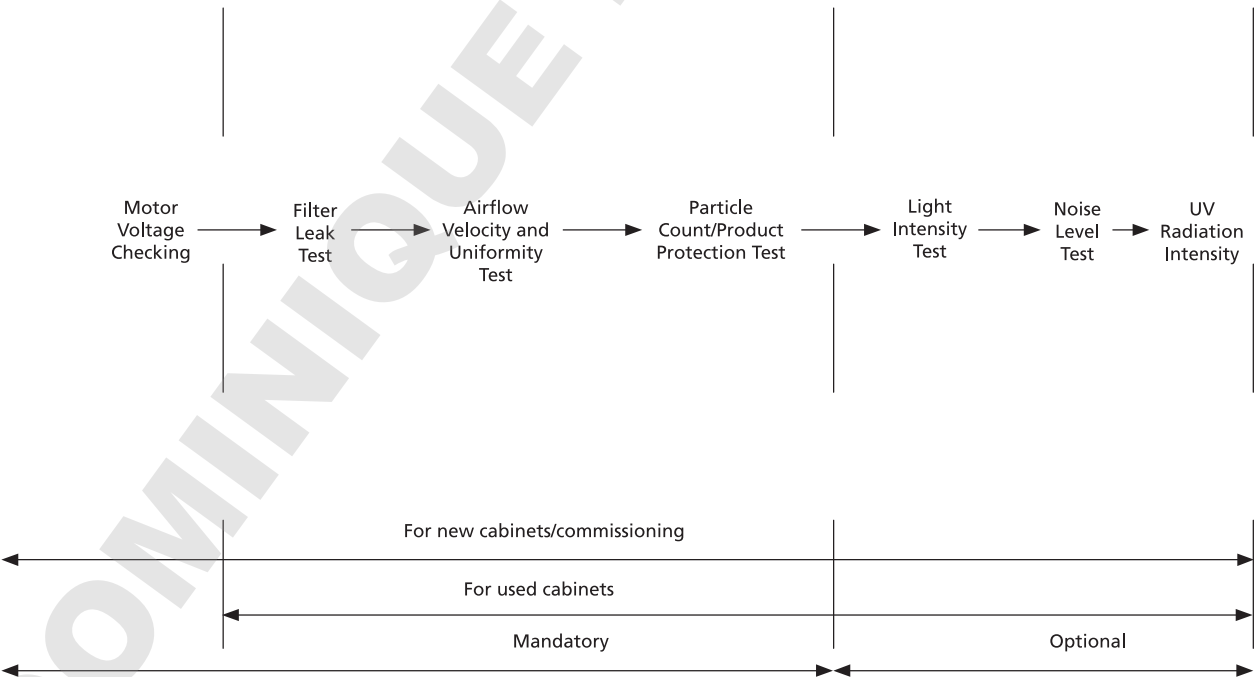
- a. Clean bench airflow velocities and flow patterns are verified against the manufacturer's specifications and relevant international standards
 - b. Filters are scan-tested to ensure they do not leak
 - c. Operator comfort tests may be performed
 - d. If airflow velocities are found to be off setpoint, adjustments are made as part of the certification process before final values are recorded.
- Airflow alarm calibration, when:
 - a. The cause of the airflow alarm cannot be determined
 - b. Re-certification indicates the displayed airflow deviates by $>0.02\text{m/s}$ (4fpm) from actual measured velocities.
(Only for products with airflow velocity displays)
 - Filter replacement, when:
 - a. The filters are clogged and the fan(s) are already adjusted to maximum setting
 - b. Filter leaks which cannot be repaired are found during scan-testing
 - Fan replacement (*typically rare*) if failure occurs.
 - Routine maintenance also includes:
 - a. Fluorescent lamp(s) replacement - typically once every 2 years.
 - b. UV lamp replacement - typically once every 1 year.

1.1 Certification Flowchart

1.1.1 SCR



1.1.2 PCR

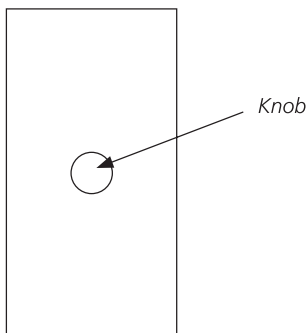


1.2 Airflow Adjustment

The speed controller is located in the electrical panel at the top of the cabinet.

Plug the multimeter probes to the Motor Voltage Sampling Port. Use the multimeter to take the motor voltage with corresponding air velocity reading.

Adjust the airflow by adjusting the speed controller. Use the knob provided to adjust the speed controller.



Speed controller

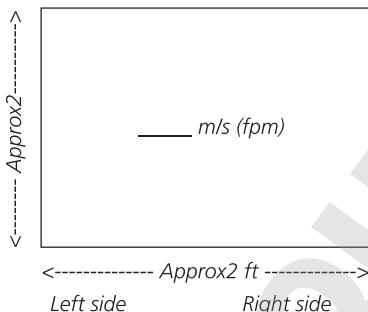
Adjust the speed controller by turning on the knob.

1.3 Unit Re-Certification

1.3.1 SCR

Steps to perform certification:

1.3.1.1 Perform Airflow Velocity and Uniformity Test



Test Points on Filter Face

A calibrated airflow meter was set up within the interior of the cabinet to measure filter airflow at a distance of 6 inches from the filter face. The measurement point was at the center of the filter face area. *Prior to this test, the cabinet blower system was factory adjusted after production.*

Filter Face Velocity : _____ m/s (fpm)

Acceptance Criteria : **Filter face velocity must be more than 0.275 m/s (55 fpm).**

Testing was performed:

In accordance with the following IEST (Institute of Environmental Sciences and Technology) contamination control document: IEST-RP-CC002.2 "Recommended Practice for Unidirectional Flow Clean Air Devices" Section 6.1

1.3.1.2 You are recommended to perform the following optional tests as well:

- a. UV radiation intensity test
- b. Electrical safety test

1.3.2 PCR

Steps to perform certification:

1.3.2.1 Perform the Natural Aerosol Challenge Filter Leak Scan (PAO Equivalent)

Using the particle counter set to monitor particles on 0.5 microns, slowly move the probe over the entire surface of the filter (including areas surrounding the gasket).

Record any "spikes" in the instantaneous particle count (which could represent a possible filter leak).

Perform the test with the cabinet sited in a normal room environment.

Acceptance Criteria : No filter leaks should be detected

Testing was performed:

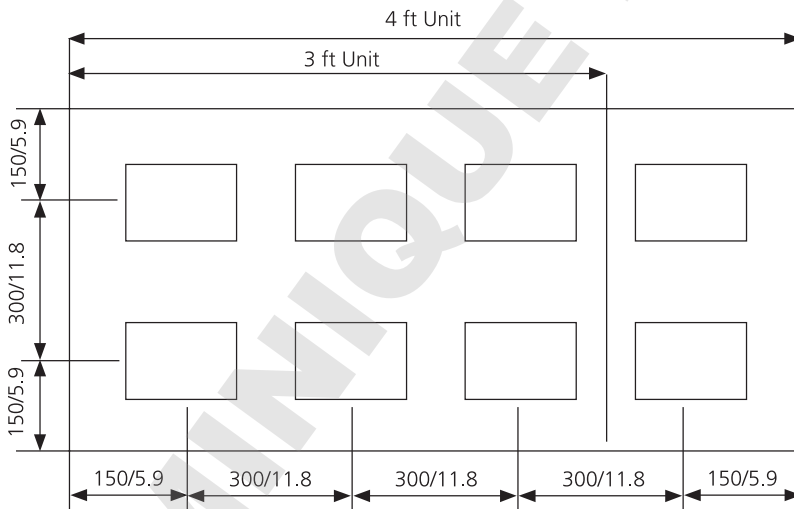
- a. In accordance with the requirements of the standards:

IEST-RP-CC001.3 "Recommended Practice for HEPA and ULPA Filters"
EN 1822 "High Efficiency Air Filters (HEPA and ULPA)"

- b. In accordance with the following IEST (Institute of Environmental Sciences and Technology) contamination control documents: IEST-RP-CC034.1 "Recommended Practice for HEPA and ULPA Filter Leak Tests", IEST-RP-CC021.1 "Recommended Practice for Testing HEPA and ULPA Filter Media" and IEST-RP-CC007.1 "Recommended Practice for Testing ULPA Filters".

1.3.2.2 Perform Airflow Velocity and Uniformity Test

The units below are in (mm/inches):



Average Velocity : _____ m/s (fpm)

Maximum Deviation : _____ %

Acceptance Criteria: Average filter face velocity of 0.275 – 0.325m/s or 55 – 65 fpm, with no single value deviating more than 30% from the calculated average.

1.3.2.3 Perform Particle Count / Product Protection Test

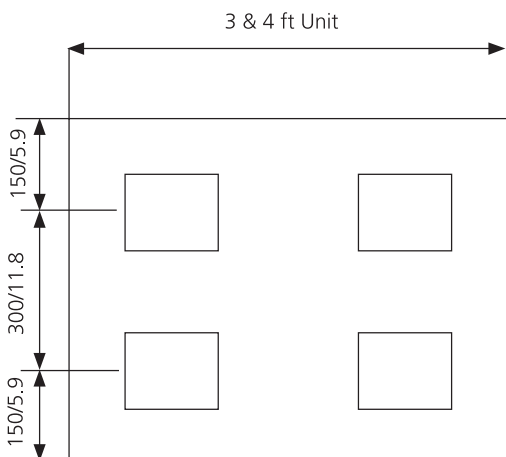
The counting was evaluated in accordance with the cleanliness requirements of the following standards:

Class 4 as per ISO 14644 • Class 10 / M 2.5 as per US Federal Standard 209E

Class 0.35 as per Australian Standard AS 1386 • Class 2 as per German Standard VDI 2083

Class D as per British Standard BS 5295 • Class 400 as per French Standard AFNOR X44101

Class 4 as per Japanese Standard JIS B9920 • Class M1000 as per Korean Standard 27030.1



Cabinet		PCR-3xx	PCR-4xx
Approximately Width (mm/in)		900/35.4	1200/47.2
Left to Right	Distance from walls (mm/in)	150/5.9	300/11.8
	Distance apart (mm/in)	600/23.6	600/23.6

Average Count : _____ Particle counter type: 0.1 micron / 0.5 micron

Acceptance criteria: 0.1 micron counter: No more than 350 particles of 0.1µm sampled in 1 ft3 of space

0.5 micron counter: No more than 10 particles of 0.5µm sampled in 1 ft3 of space

Counting status : As-built

Testing was performed:

- a. In accordance with the cleanliness requirements of the standards above.
- b. In accordance with the following IEST (Institute of Environmental Sciences and Technology) contamination control documents: IEST-RP-CC002.2 "Recommended Practice for Unidirectional Flow Clean Air Devices" Section 6.6 and IEST-G-CC1001 "Technical Guide for Counting Airborne Particles for Classification and Monitoring of Cleanrooms and Clean Zones"

1.3.2.4. You are recommended to perform the following optional tests as well:

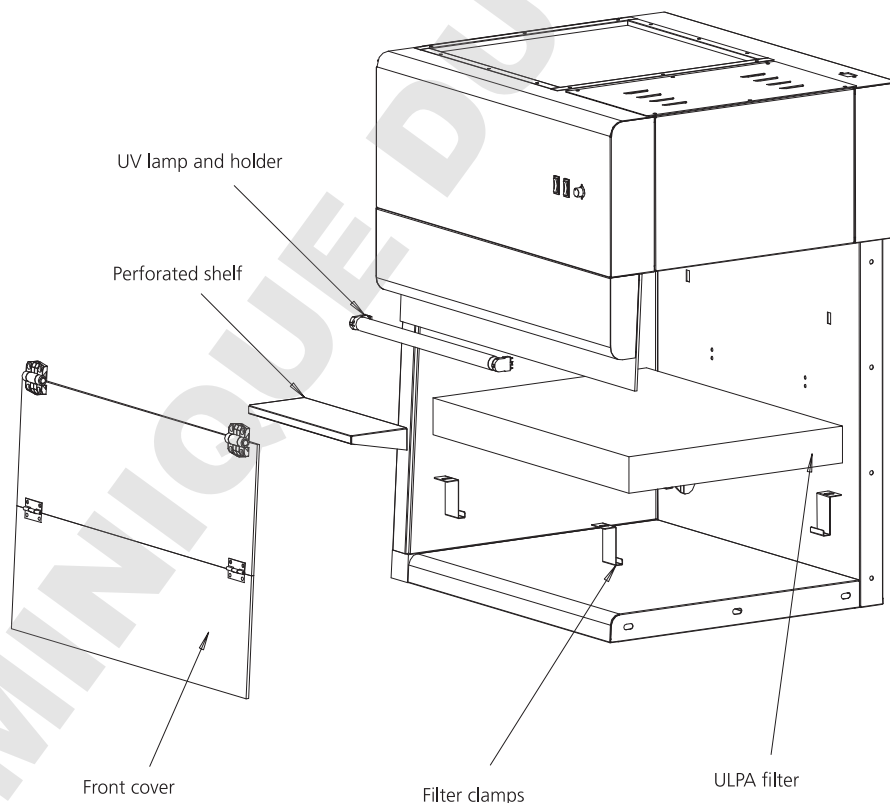
- a. Operator comfort tests: light and noise level
- b. Electrical safety test
- c. UV radiation intensity test

Esco conducts training courses on the validation and certification of laminar flow cabinets. If you are interested you are most welcome to contact Esco or your nearest Esco distributor.

1.4 Replacement of Filter

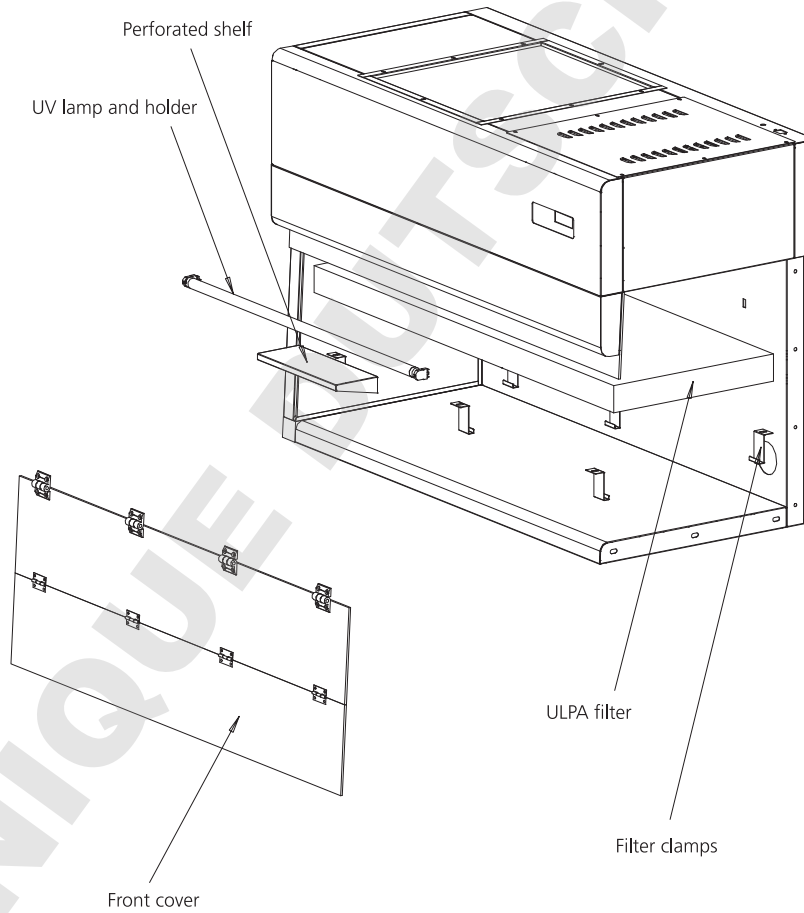
SCR

1. Unscrew and remove front cover
2. Unscrew and remove the perforated shelf
3. Unscrew and remove the UV lamp and unsnap the holder
4. Unbolt and remove the filter clamp ensure to hold the filter when doing this
5. Carefully remove the filter and replace
6. Reverse above steps
7. Re-certify the cabinet



PCR

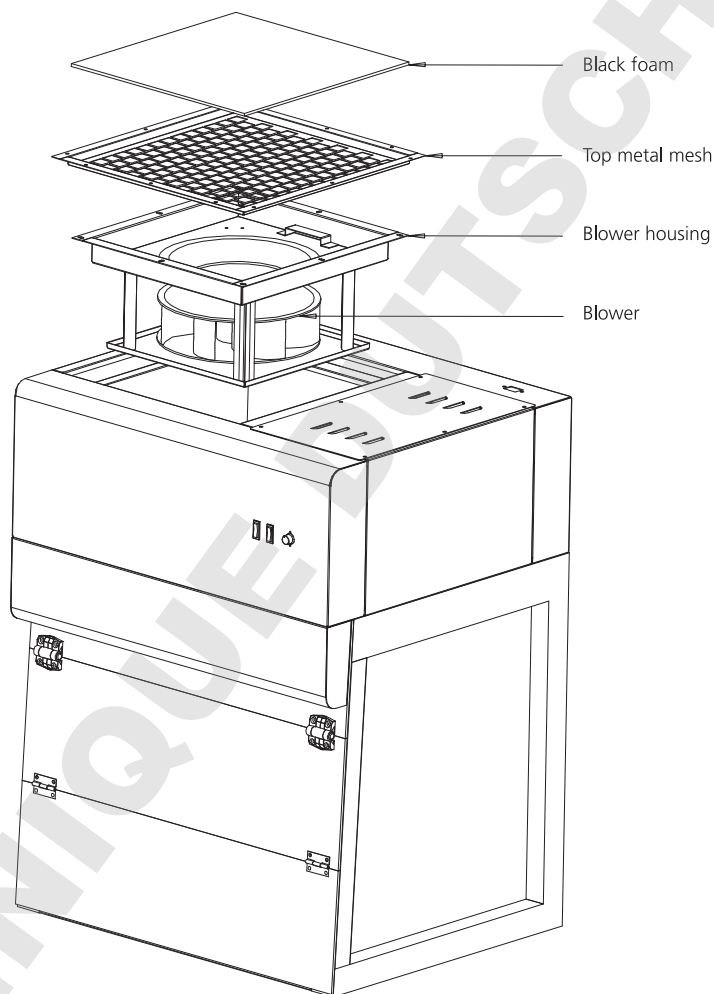
1. Unscrew and remove front cover
2. Unscrew and remove the perforated shelf
3. Unscrew and remove the UV lamp and unsnap The holder
4. Unbolt and remove the filter clamp. Ensure to hold the filter when doing this
5. Carefully remove the filter and replace
6. Reverse above steps
7. Re-certify the cabinet



1.5 Replacement of Blower

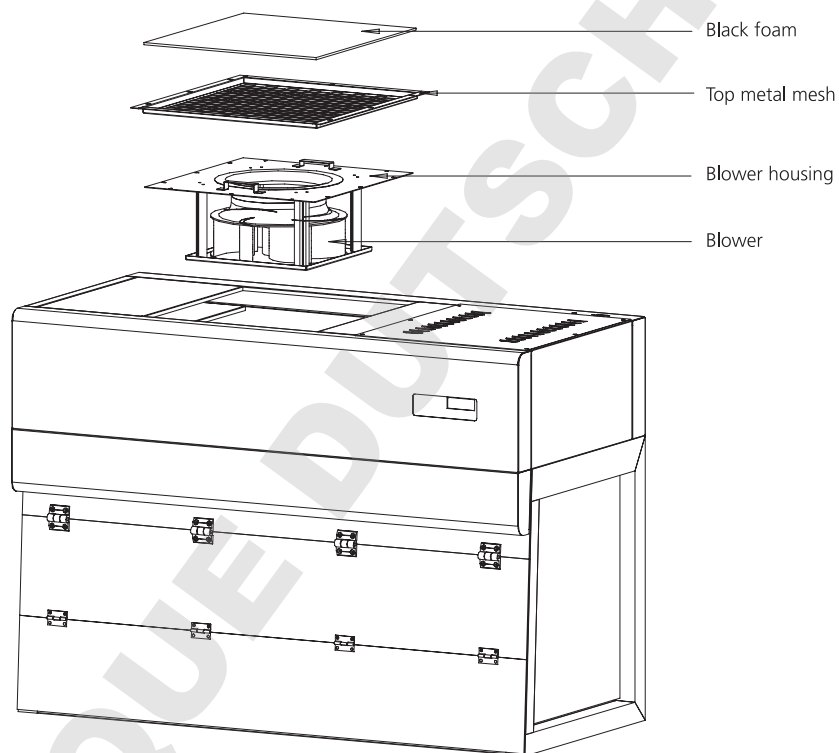
SCR

1. Remove the black foam at top exhaust.
2. Unscrew the top metal mesh and remove.
3. Disconnect the blower wiring
4. Unscrew the blower mounting house and take out.
5. Replace the blower and reverse above steps.



PCR

1. Remove the black foam at top exhaust
2. Unscrew the top metal mesh and remove
3. Disconnect the blower wiring
4. Unscrew the blower mounting house and take out
5. Replace the blower and reverse above steps
6. Re-certify the cabinet



1.6 Replacement of Fluorescent Lamp and UV Lamp

Replacement of Fluorescent Lamp

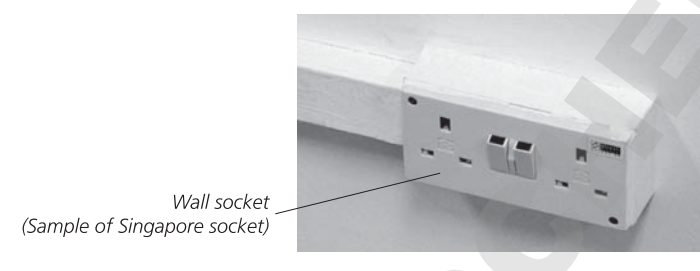
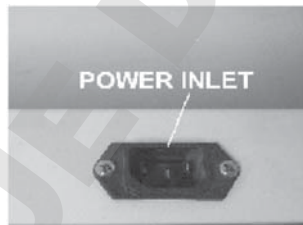
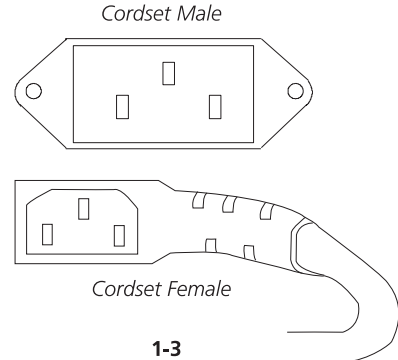
- Before changing the fluorescent bulbs, ensure that the cabinet is powered down and disconnected from the electrical supply.
- Locate the bulbs.
- Remove the power clips at the ends of the bulbs by gently pulling whilst holding the bulb steady.
- Remove the bulbs from the mounting clips and replace with new ones.
- Replace the power clips on the ends of the new bulbs and ensure they are firmly seated.
- Reconnect the cabinet to the electrical supply and test the bulbs for proper operation.

Replacement of UV Lamp

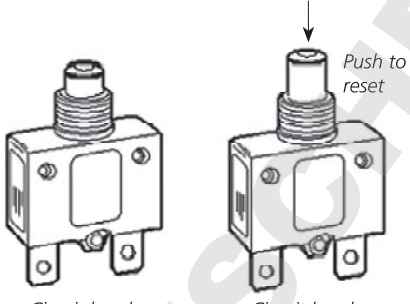
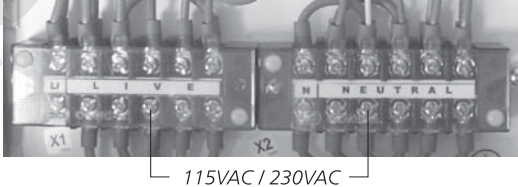
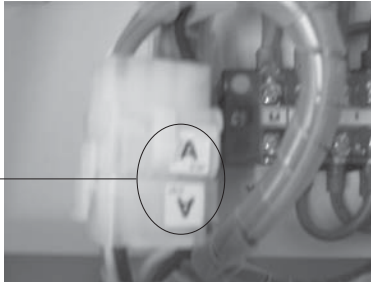
- Disconnect the electrical connections
- Take out the old UV lamp by rotating 90° counter-clockwise and pull downward.
- Install the new UV lamp by pushing it upward and rotate 90° clockwise.

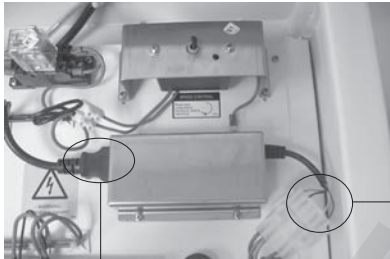
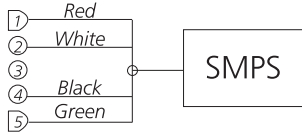
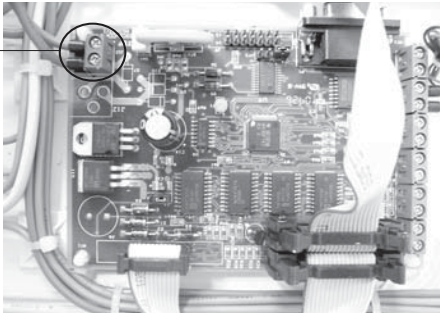
CHAPTER 2 Troubleshooting

This section helps you troubleshoot some of the common problems you might face while operating this clean bench. Should you have any queries left unanswered here, please feel free to contact Esco.

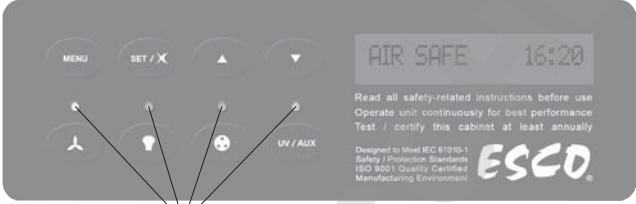
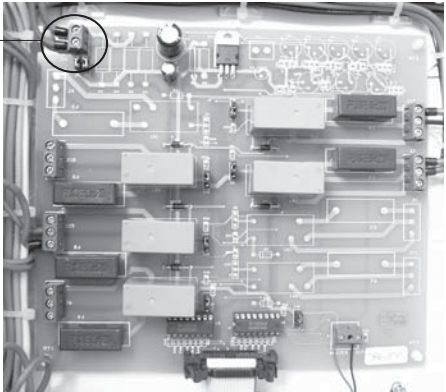
Problem	Possible Cause	Corrective Action
Cabinet does not start (LCD, button, fan, light, and UV are all inoperative)	Power Failure	<ul style="list-style-type: none"> • Check if there is power at the wall/building socket. • You can use voltmeter or test pen to check power on the wall/building socket.
		
	Power cord is not connected properly or faulty	<ul style="list-style-type: none"> • Check whether power cord has been connected properly into wall/building socket and also into the unit. • Check whether the power cord is giving power, measure the AC voltage between the live and the neutral terminal of the cord by using voltmeter (see Figure 1-3). • If the voltage is NOT within +/-2% of the wall socket voltage, replace the cord. • If the voltage is within +/-2% of the wall socket voltage, please proceed to next step.
		

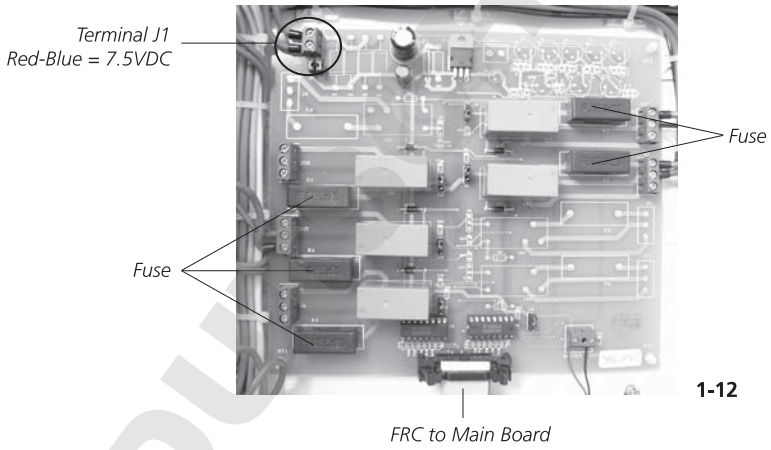
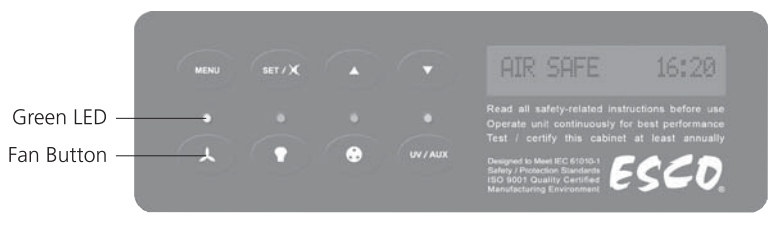
DOMINIQUE

<p>Cabinet does not start (LCD, button, fan, light, and UV are all inoperative)</p>	<p>Circuit breaker has tripped (for PCR only)</p>	<ul style="list-style-type: none"> • If there is power on wall socket and cord, check whether circuit breaker has tripped. • The circuit breaker can be found right beside the cabinet power inlet. <p>Note: <i>If circuit breaker has tripped, do not reset the breaker before checking all electrical components and wiring connections. (See Figure 1-4).</i></p> <ul style="list-style-type: none"> • Does the cabinet operate correctly after resetting the circuit breaker? If not proceed to next step.
	 <p style="text-align: center;"> Circuit breaker (normal condition) Circuit breaker (tripped condition) 1-4 </p>	
	<p>Improper connection</p>	<ul style="list-style-type: none"> • Locate electrical panel at the top right portion of the cabinet (with red metal cover). • Open electrical panel and ensure cabinet is plugged in to main power supply. • Carefully measure AC voltage between any LIVE and NEUTRAL pin on the terminal block inside electrical panel (See Figure 1-5). • The voltage should be 230Vac or 115Vac +/- 10%. • See Layout A at the end of this section to locate connector A and find pin numbering system of the connector. • If the voltage is out of the range, check cable connection at connector A pin 1, 2 and 3. • At connector A, confirm the voltage is correct. AC voltage between pin 1 and 2 must be 230Vac or 115vac +/-10%.
	 <p style="text-align: center;">1-5</p>  <p style="text-align: center;">1-6</p>	

<p>Cabinet does not start (LCD, button, fan, light, and UV are all inoperative)</p>	<p>Defective power supply (SMPS) (for PCR only)</p>	<ul style="list-style-type: none"> • Unit must be turned on to perform this test. • See Layout A at the end of this section to locate the SMPS. It is inside the electrical panel and covered by a stainless steel box. • Checking SMPS output: Disconnect the 5-pin connector attached to the SMPS output then measure the DC voltage between Red (pin 1) and White (pin 2) cables on the SMPS side. See Figure 1-7 below. • The voltage should be in range of +7.5VDC +/- 10%. • If out of range, please check incoming power to the SMPS Molded cord into SMPS – check terminal where the cord is connected. The input of SMPS should be 230Vac +/- 10% for PCR-XA1/3 or 115Vac +/- 10% for PCR-XA2/4. If input is correct but output is not, then replace the SMPS.
		
	<p>Connection problem to main board (for PCR only)</p>	<ul style="list-style-type: none"> • See Layout A at the end of this section to locate the main board at electrical panel. • Measure the incoming voltage on the Main Board at terminal J13 (Note polarity, BLUE wire closest to edge is negative -). See Figure 1-9 below to locate terminal J13. • Voltage should be between 6.75 – 8.25VDC. • If voltage is out of range, check connection between SMPS and main board. • If voltage is correct, proceed to next step.
<p>Terminal J13 Red-Blue = 7.5VDC</p>		

DOMINIQUE DUBUCHER SAS

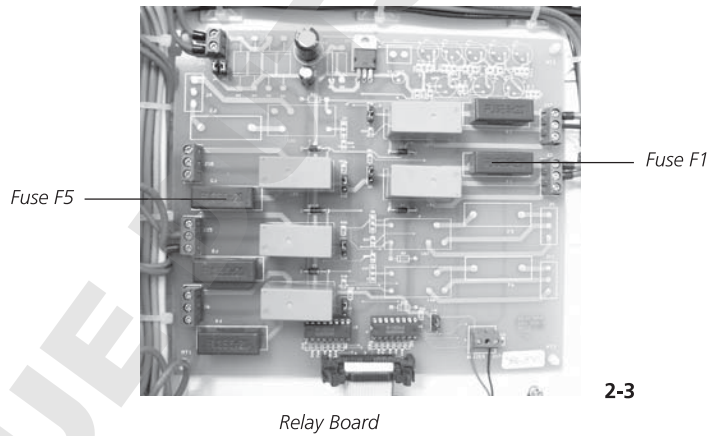
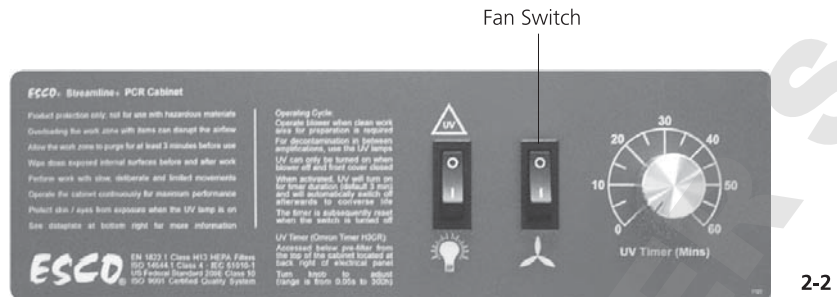
<p>Cabinet does not start (LCD, button, fan, light, and UV are all inoperative)</p>	<p>Defective main board (for PCR only)</p>	<ul style="list-style-type: none"> Restart the cabinet 2 to 4 times. The Main Board is defective if the Main Board incoming supply is between 6.75 – 8.25VDC AND: <ul style="list-style-type: none"> All LED's on the control panel are off The LCD is blank There is no Buzzer sound If these conditions exist replace the Main Board. <p>Note: When replacing main board, please re-connect all the wires back correctly. Any wrong wiring may result in damage.</p> If these conditions DO NOT exist proceed to next step.
	 <p>LED</p> <p>Membrane</p> <p>1-10</p>	
	<p>Connection problem to relay board (for PCR only)</p>	<ul style="list-style-type: none"> See Layout A at the end of this section to locate the relay board inside electrical panel. Measure the incoming voltage on the Relay Board at terminal J1 (Note polarity, BLUE wire closest to edge is negative -). See Figure 1-11 below to locate terminal J1. Voltage should be between 6.75 – 8.25VDC. If voltage is out of range, check connection between SMPS and relay board. If voltage is correct, proceed to next step.
	 <p>Terminal J1 Red-Blue = 7.5VDC</p> <p>Relay Board</p> <p>1-11</p>	

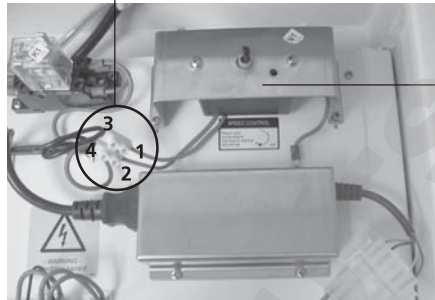
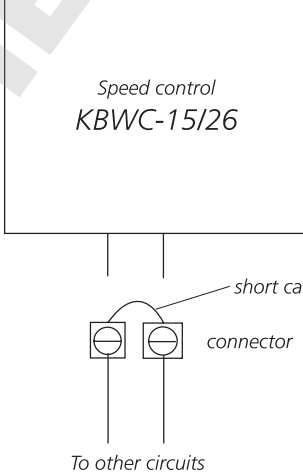
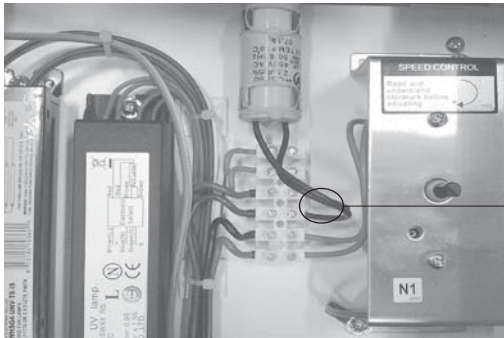
<p>Cabinet does not start (LCD, button, fan, light, and UV are all inoperative)</p>	<p>Defective relay board (for PCR only)</p>	<ul style="list-style-type: none"> • Ensure the following are correct: <ul style="list-style-type: none"> - Main Board is operational. - Flat Ribbon cable is installed correctly to relay board and main board and shows no physical damage. - Relay board has the correct incoming voltage (6.75 – 8.25VDC). - Check all fuses on relay board: Turn off power by unplugging the cabinet from the main supply. Remove fuses and physically inspect or check continuity. • Turn the cabinet on by connecting to the main supply. If the FAN, LIGHT, and UV cannot be controlled, replace the Relay Board. <p>Note: When replacing relay board, please re-connect all the wires back correctly. Any wrong wiring may result in damage.</p>
		
<p>Blower doesn't function</p>	<p>Fan is Off</p>	<p>For PCR:</p> <ul style="list-style-type: none"> • Switch on the Fan by pressing Fan button on control panel. See Figure 2-1 below. • Enter the Fan PIN number if required (default is 0001) • The LED for FAN should illuminate and the FAN should start. • If the FAN does not come on, proceed to next step. • If the LED does not illuminate, check connection from control panel to main board or replace the membrane. <p>For SCR:</p> <ul style="list-style-type: none"> • Switch on the Fan by switching the rocker switch to "I" or on position at control panel. See Figure 2-2 below. • If the FAN does not come on, check for loose or improper wiring connections at the back of the switch. • If the problem persists, proceed to next step.
		

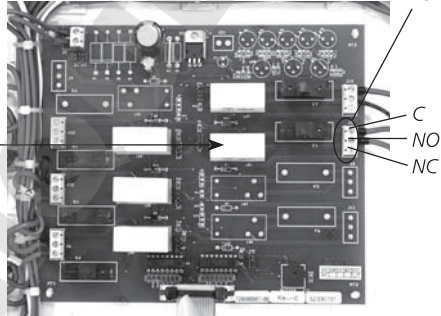
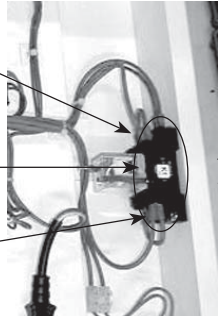
Blower doesn't function

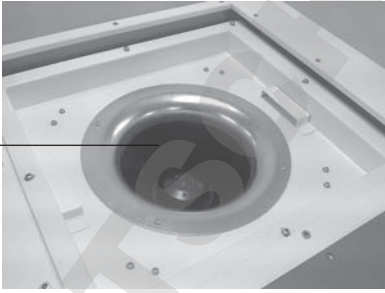
Fuse F1 is blown
(for PCR only)

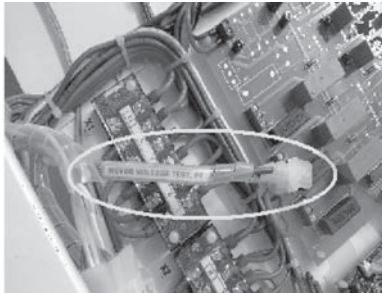
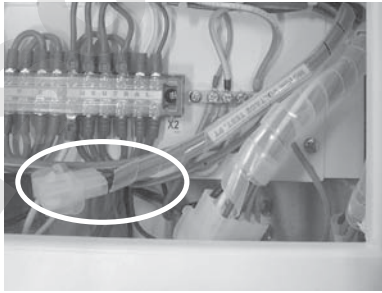
- Unplug the cabinet from main supply.
- Open the top access panel and locate electrical panel behind it.
- See Layout A at the end of this section to locate the relay board inside electrical panel.
- Check Fuse F1 on relay board. See Figure 2-3 below.
- If fuse F1 is blown, as temporary solution, use F5 to replace F1. The fuse F5 is not used and is a spare fuse.
- If fuse F1 is okay, proceed to possible cause 3.


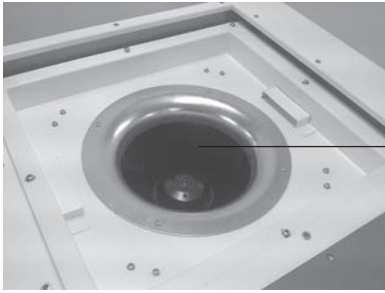
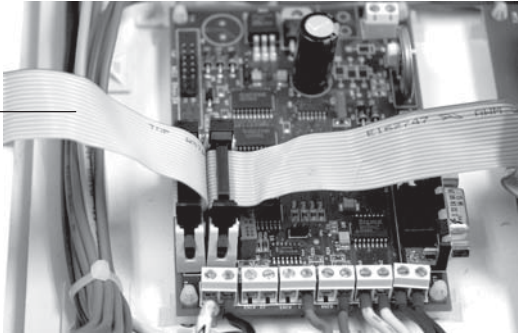


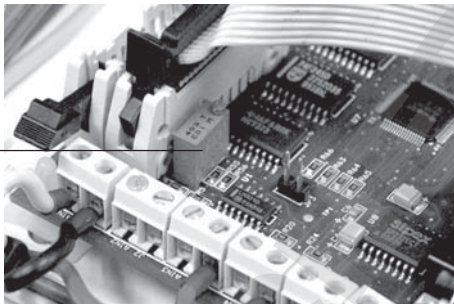
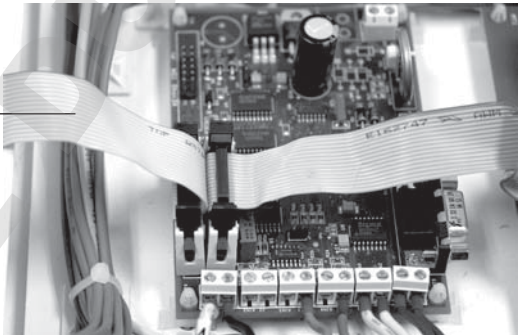
<p>Blower doesn't function</p>	<p>Faulty motor speed controller</p>	<ul style="list-style-type: none"> • Unplug the cabinet from main supply. • Open electrical panel and see Layout A/B at the end of this section to locate the motor speed controller. • Add a jumper wire between the 2 cables going to speed control. See Figure 2-4, 2-5. • Plug the cabinet to the main supply. • If the fan operates properly, the speed controller is defective and need to be replaced. • If the fan does not operate, the problem is not with the speed control. Proceed to next step.
	<p>Disconnect cables 1 and 2 on speed control. Short cables 3 and 4 with a jumper wire.</p>  <p style="text-align: right;">Speed Controller</p> <p style="text-align: right;">2-4</p>	 <p style="text-align: center;">2-5</p>
	<p>Faulty capacitor</p>	<ul style="list-style-type: none"> • Unplug the cabinet from main supply. • See Layout A/B at the end of this section to locate the capacitor near the blower compartment. • See Figure 2-6 below, disconnect two cables of capacitor. • Using a capacitance meter or a multimeter set to capacitance measurement record the value across the two capacitor cables. • Correct value is shown in table 2 below. If the value is out of given ranges, replace it. • If the capacitance is within the given ranges proceed to next step. <p>Warning: The capacitor may still have some electrical charges if the cabinet was switched on prior doing this checking. Wait for 1-2 minutes and check the capacitor voltage using a voltmeter to ensure the capacitor were discharged (voltage less than 5Vac) prior disconnecting the capacitor.</p>
 <p style="text-align: right;">Disconnect 2 cables from capacitor. Measure capacitance across the terminal with capacitance meter.</p> <p style="text-align: right;">2-6</p>		

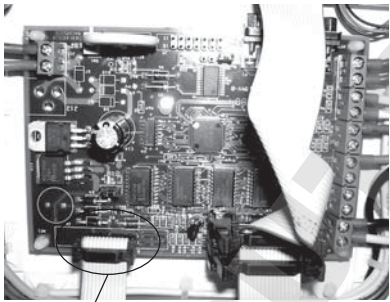
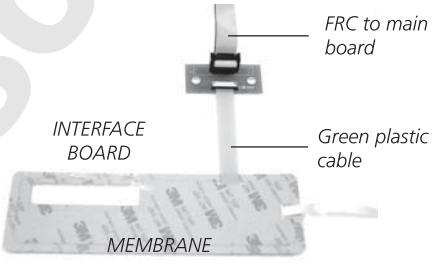

<p>Blower doesn't function</p>	<table border="1"> <thead> <tr> <th>Cabinet</th> <th>Voltage</th> <th>Cabinet Model</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">PCR/SCR</td> <td rowspan="2">115VAC ± 10%</td> <td>2, 3 ft</td> <td>8-12 µF</td> </tr> <tr> <td>4 ft</td> <td>17-23 µF</td> </tr> <tr> <td rowspan="2"></td> <td rowspan="2">230VAC ± 10%</td> <td>2, 3 ft</td> <td>2.2-2.7 µF</td> </tr> <tr> <td>4 ft</td> <td>3.5-4.5 µF</td> </tr> </tbody> </table> <p style="text-align: right;">Table 2</p>	Cabinet	Voltage	Cabinet Model	Capacitance	PCR/SCR	115VAC ± 10%	2, 3 ft	8-12 µF	4 ft	17-23 µF		230VAC ± 10%	2, 3 ft	2.2-2.7 µF	4 ft	3.5-4.5 µF
	Cabinet	Voltage	Cabinet Model	Capacitance													
	PCR/SCR	115VAC ± 10%	2, 3 ft	8-12 µF													
4 ft			17-23 µF														
	230VAC ± 10%	2, 3 ft	2.2-2.7 µF														
		4 ft	3.5-4.5 µF														
<p>Faulty motor speed controller</p> <p>For PCR only:</p> <ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • Check LS1 relay on the Relay Board. See Figure 2-7 below. • Make sure all wiring and connections are correct. • On terminal J2, check the Normally Open (NO) to Common and Normally Closed (NC) to Common (C) circuits by checking continuity. Normally Open to Common doesn't have continuity while the Normally Closed to Common has continuity. • If the NO to Common and NC to Common contacts are not correct, replace the Relay Board. • If the NO to Common and NC to Common contacts are correct, proceed to the next step. <p>For SCR/PCR:</p> <ul style="list-style-type: none"> • Check K1 relay. See Layout A at the end of this section to locate the K1 relay. • With cabinet still switched-off, check if the cables connected to the relay socket are tight. See Figure 2-8 below. • Visually inspect relay for burnt contacts or flash marks on the inside of the relay case (Relay is clear case) • Check NO to Common and NC to common contacts on relay K1, the method is same as for LS1 relay. • If the relay K1 shows signs of arching (burnt marks) or the NO-C and NC-C circuits are not correct, replace the relay. 																	
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Relay Board</p> <p>2-7</p> </div> <div style="text-align: center;">  <p>2-8</p> </div> </div>																	

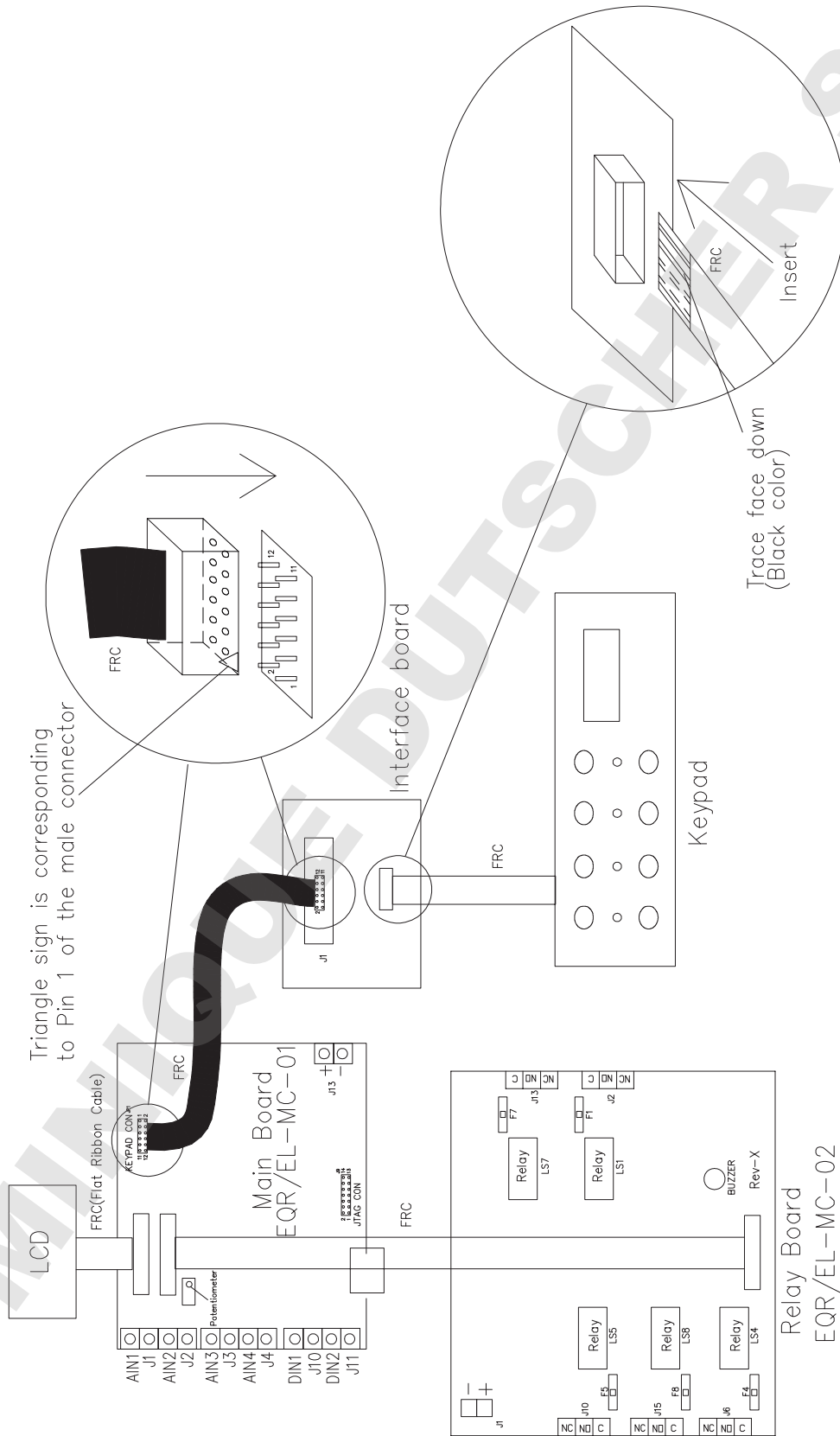
Blower doesn't function	Auto-thermal cut-off	<ul style="list-style-type: none"> • Check the Fan for overheating – The motor has an in-built thermal cut off. • Wait 60 minutes with the FAN turned off and then try to restart. • If the FAN restarts determine why there is excessive heat in the cabinet. • If the FAN does not restart proceed to the next step.
	Motor failure	<ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • Check motor condition. If physical damage is present, like fan blades bent, cracked or chipped off, replace blower. See Figure 2-9 below. • To replace the blower, please follow instruction which is available in this manual under Service Section.
		
Airflow is not at nominal velocity	External air interference	<ul style="list-style-type: none"> • Ensure that there are no external sources of airflow disturbance like air conditioner vent, window or incidences of door opening or people walking fast near the cabinet. • Ensure that there is no air disturbance or obstruction on top of the pre-filter of the cabinet. • If there is no external air blockage/interference, switch "ON" the blower fan. • Open the top access cover and locate electrical panel inside. • See Figure 3-1(PCR) or Figure 3-2(SCR) below to locate motor voltage sampling port. • Using voltmeter, measure AC voltage at the motor voltage sampling port as described in the re-certification section of this manual. This is to measure the motor voltage. • If the motor voltage is lower than the Nominal Voltage value recorded in factory test report, adjust the speed control to get output voltage to blower as specified in the Test Report – Test Conditions Documentation Sheet. • If still the airflow is not at nominal velocity, proceed to next step

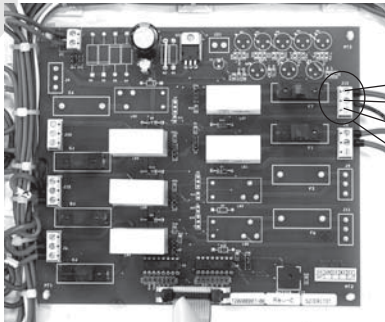
<p>Airflow is not at nominal velocity</p>	<p>Low building supply voltage (if new cabinet, check this first)</p>	<ul style="list-style-type: none"> • Switch "ON" the blower fan. • Open the top access cover and locate electrical panel inside. • See Figure 3-1(PCR) or Figure 3-2(SCR) below to locate motor voltage sampling port. • Using voltmeter, measure AC voltage at the motor voltage sampling port as described in the re-certification section of this manual. This is to measure the motor voltage. • For new cabinet, if the motor voltage is lower than the Nominal Voltage value recorded in factory test report, adjust the speed control to get output voltage to blower as specified in the Test Report – Test Conditions Documentation Sheet. • For cabinet that has been used for more than 1 year, refer to last motor Nominal Voltage from last certification report or if not available, measure the actual airflow on cabinet and increase motor voltage accordingly to achieve nominal airflow velocity. • If motor voltage is same as last Nominal Voltage, proceed to next step.
		<div style="display: flex; justify-content: space-around;">   </div> <p style="display: flex; justify-content: space-around;"> 3-1 3-2 </p>
	<p>Filter loaded or wrong speed controller setting</p>	<ul style="list-style-type: none"> • Switch "ON" the blower fan. • Lift-up the top pre-filter and open cover to access the electrical panel. Locate Motor Voltage Sampling Port. • Plug in the voltmeter to the Motor Voltage Sampling Port. • Measure the actual airflow velocity using anemometer or flowhood. If actual airflow is not okay, please adjust motor speed controller accordingly until actual airflow is okay. • Adjust the blower voltage until airflow is at nominal point. • If the blower is already operating at maximum voltage and the airflow is still lower than nominal point, it may be due to filter being loaded. Please change the filter. <p>Note: <i>The cabinet must be certified at least annually.</i></p> <ul style="list-style-type: none"> • If the blower is already operating at maximum voltage and the airflow is still low due to filter loaded, it's time to change the filter. Instruction on how to replace the filter is available in this manual under Service Section. • If filter is not loaded, proceed to next step.
	<p>Fluctuating Voltage</p>	<ul style="list-style-type: none"> • Measure and check voltage stability of the wall/building supply. • If the building supply voltage fluctuates more than the stated tolerance (+/- 2%), connect the cabinet to a voltage stabilizer. • If the building supply voltage fluctuation is below +/-2%, proceed to next step.
<p>Motor failure</p>	<ul style="list-style-type: none"> • Check the motor. If motor is not running, refer to 'Blower doesn't function' problem. 	

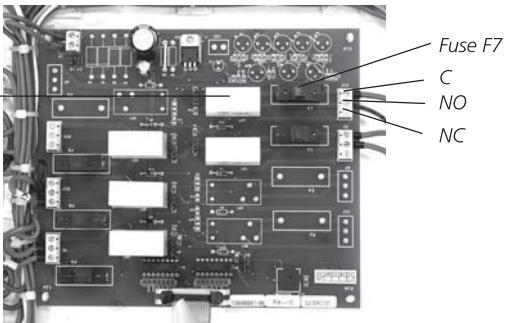
Contaminated samples	Low airflow	<ul style="list-style-type: none"> Adjust the speed control (located inside the electrical panel, on top of the cabinet) to get the optimum airflow as stated in the test report.
	Leaking downflow filter	<ul style="list-style-type: none"> Perform the filter integrity test. Refer to test report. Change the downflow filter if filter is found out to be leaking. Re-certify the cabinet after the new filter has been installed.
Excessive fan noise	Faulty Capacitor	<ul style="list-style-type: none"> Refer to Problem 2: Blower doesn't function – possible cause 4 – Faulty capacitor.
	Resonance	<ul style="list-style-type: none"> Plug the cabinet power cord to the wall outlet and lift-up the top pre-filter. Open cover to access the electrical panel. See Layout A at the end of this section to locate the speed controller inside electrical box. Increase the motor speed by 5 – 10 VAC. Check whether the noise is already gone. If the noise is gone, measure the actual airflow velocity. If the velocity is still in the acceptable range, keep it. If velocity is out of acceptable range and noise still persists, proceed to the next step.
	Loosed motor or impeller wheel mounting	<ul style="list-style-type: none"> Refer to above Blower doesn't function--> Faulty Capacitor section, to check the capacitor, and replace if necessary. Open the blower access panel (see Figure 5-1.) and check if the blower mounting bolts have been fully tightened. Also check whether the motor can rotate properly and not loosened. See Figure 5-2 below. If blower is physically damaged, replace it. Instruction on how to replace the blower is available in this manual under Service Section.
	 <p>5-1</p>	 <p>5-2</p>
Blank LCD	Connection problem	<ul style="list-style-type: none"> Unplug the cabinet from the main supply. Open the top access cover and locate electrical panel behind it. Open electrical panel and see Layout A at the end of this section to locate the main board inside electrical panel. Check whether LCD FRC (Flat Ribbon Cable) has been inserted properly into its socket on the main board. See Figure 6-1 below.
	 <p>6-1</p>	

Blank LCD	Contrast problem	<ul style="list-style-type: none"> • Turn on the cabinet by connecting to the main supply. • Adjust the potentiometer on main board by rotating the top metal part using flat screw driver to achieve the best LCD contrast. Anti clock-wise direction will increase the contrast. See Figure 6-2 below. • If the LCD remains blank, replace it.
	 <p style="text-align: right;">6-2</p>	
	Defective LCD	<ul style="list-style-type: none"> • Connect a new LCD to the LCD port on main board (refer to possible cause 1 above on how to find the LCD port). • If the new LCD functions properly, this means that the current one is defective. Replace it. To replace LCD, need to uninstall the fluorescent light and its metal deflector first. • If the new LCD is not working, check its cable or replace the main board.
 <p style="text-align: right;">6-3</p>		

	<p>Connection problem</p>	<ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • Open the top access cover and locate electrical panel inside. • See Layout A at the end of this section to locate the main board inside electrical panel. • See Figure 7-1 below and ensure FRC cable going to interface board is connected properly. The triangle sign on the female connector indicates PIN number 1. • Interface board and membrane/keypad are located behind the blue panel, underneath the light metal deflector. • With the cabinet still turned-off, uninstall the fluorescent light and metal deflector to access the interface board. See Figure 7-3 below. • See Figure 7-2 below for the proper connection between main board, interface board, and membrane/keypad. • Check if the green plastic cable from the membrane has been inserted properly into the interface board. Follow Figure 7-4 for the correct orientation of connector.
<p>Inoperative buttons</p>	 <p>Cable to interface board</p> <p>7-1</p>	 <p>FRC to main board</p> <p>INTERFACE BOARD</p> <p>MEMBRANE</p> <p>Green plastic cable</p> <p>7-2</p>  <p>Remove front screws and thumbs screws inside that holds the glass in place</p> <p>UV lamp</p> <p>Fluorescent lamp</p> <p>Remove the glass to access the lamps inside the blue panel</p> <p>UV lamp holder</p> <p>Fluorescent lamp holder</p> <p>7-3</p>

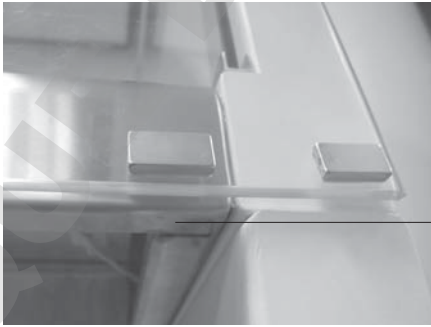


<p>Inoperative buttons</p>	<p>Defective Cable and / or Interface Board and / or keypad</p>	<ul style="list-style-type: none"> • Replace them one by one, to check which one(s) among them is/are defective. • Replace the defective part(s).
<p>Light always OFF</p>	<p>Faulty fluorescent tube</p>	<ul style="list-style-type: none"> • Replace the faulty fluorescent tube. • Fluorescent tube is located inside the blue panel (Refer to Figure 7-3 for lamp location and replacement).
	<p>Faulty Fluorescent ballast</p>	<p>For PCR:</p> <ul style="list-style-type: none"> • See Layout A at the end of this section to locate the fluorescent ballast, connector B, and relay board inside electrical panel. • Turn on the cabinet by connecting to the main supply, then turn on the light by pressing LIGHT button on membrane/keypad. • Check AC voltage at ballast input (between pin NO on J13 terminal on relay board to neutral), see Figure 8-1 below. • It should be 230Vac +/- 10% for 230V cabinet or 115Vac +/- 10% for 115V cabinet. • If not, check the LS7 relay and F7 fuse (refer to possible cause "Faulty relay or fuse" below). <p>For SCR:</p> <ul style="list-style-type: none"> • See Layout B at the end of this section to locate the fluorescent ballast and connector B inside electrical panel. • Turn on the cabinet by connecting to the main supply, then switch on the light with the LIGHT rocker switch on control panel. • Check AC voltage at ballast input (between pin connector A-5 to neutral). It should be 230Vac +/- 10% for 230V cabinet or 115Vac +/- 10% for 115V cabinet. • If not, check the light rocker switch connection and building voltage supply. <p>For PCR/SCR:</p> <ul style="list-style-type: none"> • Disconnect male connector B on electrical panel. • Turn on the unit by connecting to the main supply. • Turn on the light, then check AC voltage at ballast output (between female connector B pin 1 and 2), it should be around 450-600Vac. • Replace ballast if output voltage is much lower than this range.
	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p><i>Black cable is ballast input (230VAC or 115VAC)</i></p> <p>C</p> <p>NO</p> <p>NC</p> <p>Terminal J13</p> </div> </div> <p style="text-align: center;">8-1</p>	

Light always OFF	Connection Problem	<p>For PCR:</p> <ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • See Layout A at the end of this section to locate the relay board, fluorescent ballast, and connector B inside electrical panel. • Check for any loosed or bad connection between relay board, fluorescent lamp ballast, and female connector B. • See Figure 8-1 to locate terminal J13 on relay board, check tightness of 2 cables connected to J13. • For connector B, disconnect the male side from electrical panel, then check male and female side for any bad connection. • Check also connection of the lamp holder (see Figure 7-3). <p>For SCR:</p> <ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • See Layout B at the end of this section to locate the fluorescent ballast and connector B inside electrical panel. • Check for any loosed or bad connection between light switch, fluorescent lamp ballast, and female connector B. • For connector B, disconnect the male side from electrical panel, then check male and female side connectors for any loose or wrong connection. • Check also connection of the lamp holder (see Figure 7-3).
	Faulty relay or fuse (For PCR only)	<ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • Open the top access cover and locate electrical panel inside. • See Layout A at the end of this section to locate the relay board inside electrical panel. • Check relay LS7 and fuse F7 on the relay board. See Figure 8-2 below. • If fuse F7 is blown, as temporary solution, use F5 to replace F1. The fuse F5 is not used and is a spare fuse. • On terminal J13, check the Normally Open (NO) to Common and Normally Closed (NC) to Common (C) circuits by checking continuity. Normally Open to Common doesn't have continuity while the Normally Closed to Common has continuity. • If the NO to Common and NC to Common contacts are not correct, replace the Relay Board.
	 <p style="text-align: center;">8-2</p>	

<p>UV Light always OFF</p>	<p>Sash not in UV state</p>	<p>Warning: Before turning the UV lamp on, make sure that the hinged window is closed. Also ensure that you are protected.</p> <p>For PCR:</p> <ul style="list-style-type: none"> • Close the hinged window for UV mode position (fully closed, see Figure 9-1 below). • If UV MODE is not displayed on the LCD, please refer to the Magnetic Switch troubleshooting section. • Switch on the UV lamp by pressing the UV button (see Figure 9-2 below). • If UV MODE is displayed on LCD but UV is not on after pressing UV button, please refer to possible cause 2-UV magnetic switch is misaligned or faulty. <p>For SCR:</p> <ul style="list-style-type: none"> • Close the hinged window for UV mode position (fully closed, see Figure 9-1 below). • Set the mechanical timer for the UV at the desired value. • If UV timer is on but UV lamp is not, please refer to possible cause 2-UV magnetic switch is misaligned or faulty.
		<div data-bbox="774 907 1125 1321" data-label="Image"> </div> <p style="text-align: right;">9-1</p> <div data-bbox="630 1355 1268 1568" data-label="Image"> </div> <p style="text-align: center;">UV Button</p> <p style="text-align: right;">9-2</p>

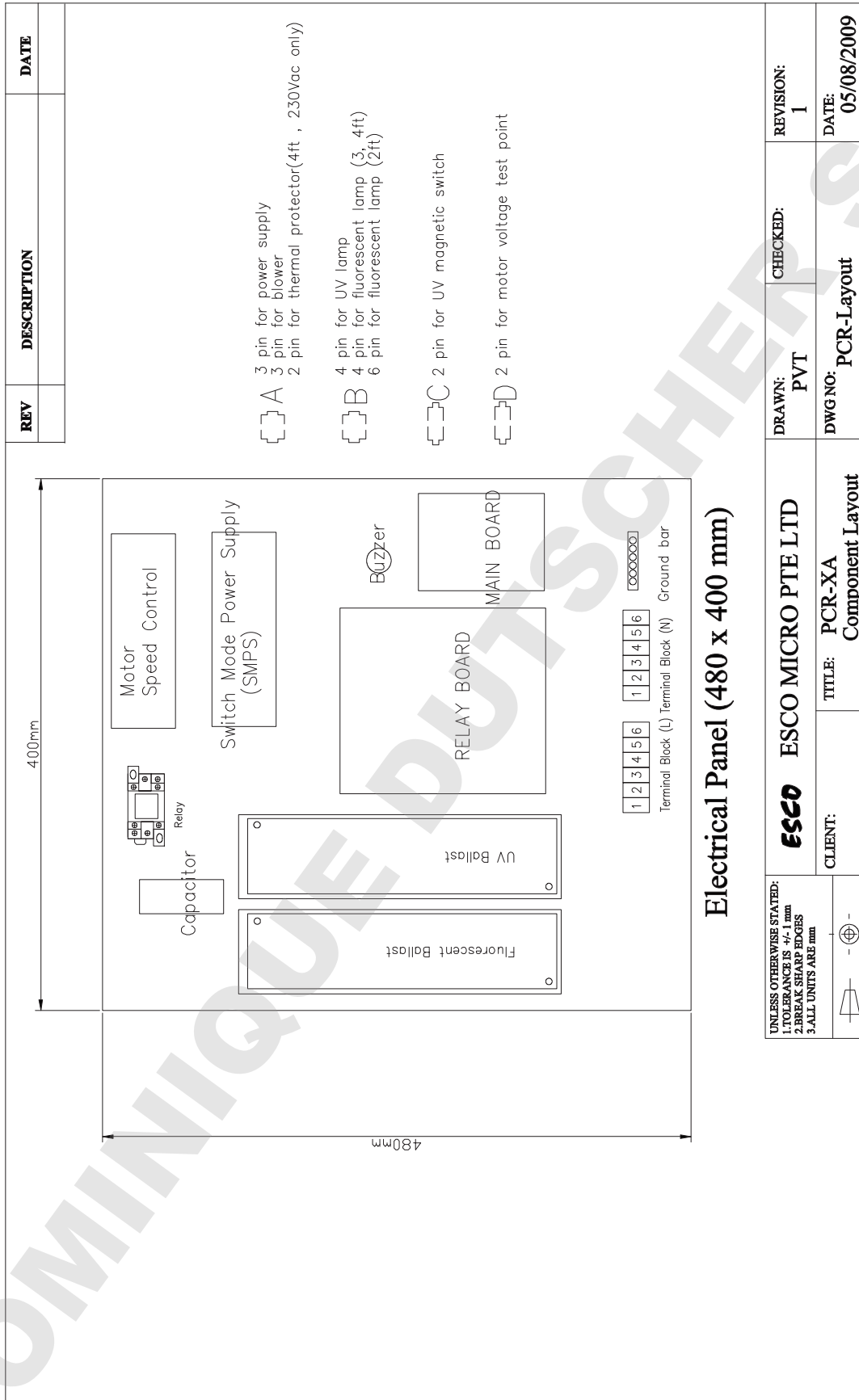
DOMINIQUE DUBOIS

<p>UV Light always OFF</p>	<p>UV magnetic switch is misaligned or faulty</p>	<p>For PCR:</p> <ul style="list-style-type: none"> • Move hinged window to Fully Closed position. The LCD should show "UV MODE". Please ensure that the hinged window is fully closed. • If the LCD showing "SASH ALARM" instead, check the magnetic switch located behind the front right corner of the table(right side). Refer to Figure 9-3 below for the location. • You will find a magnetic strip attached on the glass directly in front of the magnetic switch when the glass is at fully closed position. • Shift the switch or magnet position so the distance between them is between 10-13mm. If the distance is too far, the switch may not be able to detect the magnet. • If the LCD still showing "SASH ALARM", the switch may be faulty (please replace it) or the connection may have problem. For checking on connection, follow next step. <p>For SCR:</p> <ul style="list-style-type: none"> • Turn off the unit. Use a continuity tester across pin connector A7 and A8 on the male connector. Please ensure that the hinged window is fully closed. • If there is no continuity, check the magnetic switch located behind the front right corner of the table(right side). Refer to Figure 9-3 below for the location. • You will find a magnetic strip attached on the glass directly in front of the magnetic switch when the glass is at fully closed position. • Shift the switch or magnet position so the distance between them is between 10-13mm. If the distance is too far, the switch may not be able to detect the magnet. • If there is still no continuity, the switch may be faulty (please replace it) or the connection may have problem. For checking on connection, follow next step.
	<div style="text-align: center;">  <p style="margin-top: 5px;"><i>Magnetic switch location is right behind the magnetic strip attached to the sash in front when the sash is fully closed</i></p> </div> <p style="text-align: center;">9-3</p>	<p>Faulty UV light</p> <ul style="list-style-type: none"> • Replace the faulty UV light. Note: typical UV light life is 8000 hours.

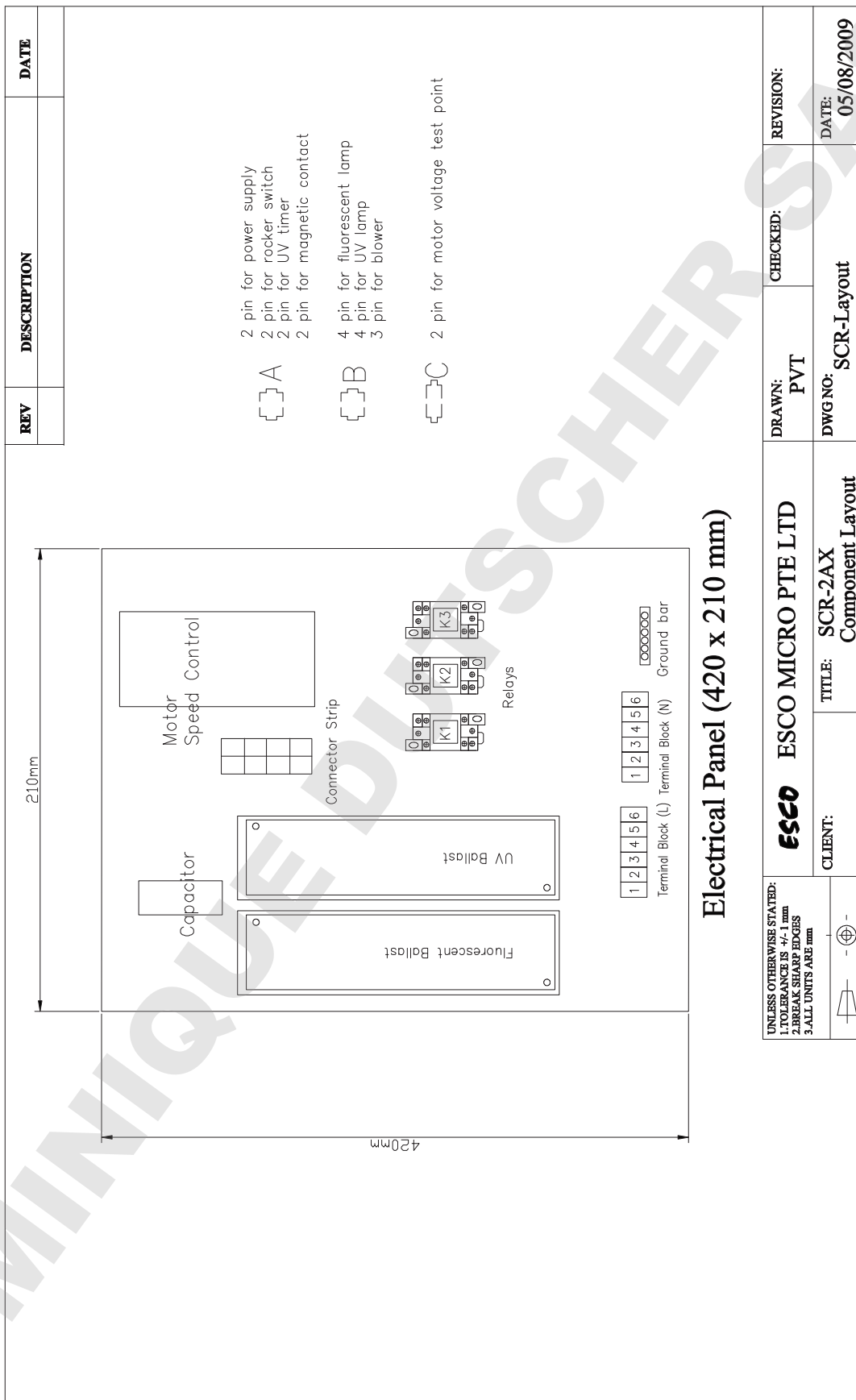
UV Light always OFF	Faulty UV ballast	<p>For PCR:</p> <ul style="list-style-type: none"> • Open the top access cover and locate electrical panel inside. • See Layout A at the end of this section to locate the UV ballast, relay board, and connector B inside electrical panel. • Turn on the cabinet by connecting to the main supply, then switch on the UV by pressing UV button on membrane/keypad. Make sure that the front cover is attached and the LCD displays UV mode. • Check AC voltage at UV ballast input (between pin NO on J15 terminal on relay board to neutral), see Figure 9-4. • It should be 230Vac +/- 10% for 230Vac cabinet or 115Vac +/- 10% for 115Vac cabinet. • If not, check the LS8 relay and F8 fuse (refer to possible cause 6 below). <p>For SCR:</p> <ul style="list-style-type: none"> • Open the top access cover and locate electrical panel inside. • See Layout B at the end of this section to locate the UV ballast and connector B inside electrical panel. • Turn on the cabinet by connecting to the main supply, then switch on the UV by turning UV timer on. Make sure that the front cover is attached so that the unit is in UV mode operation. • Check AC voltage at UV ballast input (between pin connector A-6 to neutral terminal block). • It should be 230Vac +/- 10% for 230Vac cabinet or 115Vac +/- 10% for 115Vac cabinet. • If not, check the UV timer, relays K1, K2, and K3 wiring connections. Verify that the building voltage is also correct and not fluctuating. <p>For PCR/SCR:</p> <ul style="list-style-type: none"> • Disconnect male connector B on electrical panel. • Turn on the unit by connecting to the main supply. • Turn on the UV, then check AC voltage at ballast output (between female connector B pin 3 and 9[for PCR], pin 7 and 8[for SCR]). It should be around 10-25Vac for 230Vac cabinet or around 450-600Vac for 115Vac cabinet. See Table 6 below. • Replace ballast if output voltage is out this range. 											
	<table border="1"> <thead> <tr> <th>Cabinet Voltage</th> <th>Connector</th> <th>Pin</th> <th>UV ballast output</th> </tr> </thead> <tbody> <tr> <td>230VAC +/- 10%</td> <td>B</td> <td>3 to 9 (PCR) 7 to 8 (SCR)</td> <td>10-25VAC</td> </tr> <tr> <td>115VAC +/- 10%</td> <td>B</td> <td>3 to 9 (PCR) 7 to 8 (SCR)</td> <td>10-25VAC</td> </tr> </tbody> </table> <p>Table 6</p>		Cabinet Voltage	Connector	Pin	UV ballast output	230VAC +/- 10%	B	3 to 9 (PCR) 7 to 8 (SCR)	10-25VAC	115VAC +/- 10%	B	3 to 9 (PCR) 7 to 8 (SCR)
Cabinet Voltage	Connector	Pin	UV ballast output										
230VAC +/- 10%	B	3 to 9 (PCR) 7 to 8 (SCR)	10-25VAC										
115VAC +/- 10%	B	3 to 9 (PCR) 7 to 8 (SCR)	10-25VAC										

	<p>Connection Problem</p> <p>For PCR:</p> <ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • Open the top access cover and locate electrical panel behind it. • See Layout A at the end of this section to locate the relay board, UV ballast, and connector B at electrical panel. • Check for any loosed or bad connection between relay board, UV lamp ballast and female connector B. • See Figure 9-4 to locate terminal J15 on relay board, check tightness of 2 cables connected to J15. • For connector B , disconnect the male side from electrical panel, then check male and female side for any bad connection. • Check also connection of the UV lamp holder (see Figure 7-3). <p>For SCR:</p> <ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • Open the top access cover and locate electrical panel behind it. • See Layout B at the end of this section to locate the relay K1, K2, and K3, UV ballast, and connector B at electrical panel. • Check for any loose or wrong connection between relays, UV lamp ballast and female connector B. See Figure 9-5 below. • For connector B, disconnect the male side from electrical panel, then check male and female side for any loose or bad connection connection. • Check also connection of the UV lamp holder (see Figure 7-3).
<p>UV Light always OFF</p>	<div data-bbox="646 1030 1085 1310" data-label="Image"> </div> <p data-bbox="734 1321 941 1377">Black cable is UV ballast (230VAC or 115VAC)</p> <p data-bbox="885 1377 933 1411">9-4</p> <div data-bbox="694 1422 1125 1792" data-label="Image"> </div> <p data-bbox="885 1803 933 1836">9-5</p>

<p>UV Light always OFF</p>	<p>Faulty relay or fuse</p>	<p>For PCR:</p> <ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • Open the top access cover and locate electrical panel inside. • See Layout A at the end of this section to locate the relay board inside electrical panel. • Check LS8 relay and fuse F8 on the relay board. See Figure 9-6 below. • If fuse F8 is blown, as temporary solution, use F5 to replace F8. The fuse F5 is not used and is a spare fuse. • On terminal J15, check the Normally Open (NO) to Common and Normally Closed (NC) to Common (C) circuits by checking continuity. Normally Open to Common doesn't have continuity while the Normally Closed to Common has continuity. • If the NO to Common and NC to Common contacts are not correct, replace the Relay Board. <p>For SCR:</p> <ul style="list-style-type: none"> • Unplug the cabinet from the main supply. • Open the top access cover and locate electrical panel inside. • See Layout B at the end of this section to locate the relay board inside electrical panel. • Check the K1, K2, and K3 relays. See Figure 9-7 below. • Check the Normally Open (NO) to Common and Normally Closed (NC) to Common (C) circuits by checking continuity. Normally Open to Common doesn't have continuity while the Normally Closed to Common has continuity. • If the NO to Common and NC to Common contacts are not correct, replace the relays.
		<div data-bbox="662 1131 1300 1422"> <p>Figure 9-6 shows a close-up of a relay board. On the left side, there are three terminals labeled NC, NO, and C. Below them is a fuse labeled Fuse F8. On the right side, there is a relay labeled Relay LS8.</p> </div> <p style="text-align: center;">9-6</p> <div data-bbox="742 1478 1173 1848"> <p>Figure 9-7 shows a close-up of a relay board with three relays labeled K1, K2, and K3. Each relay has terminals for NC, NO, and COM. The text 'Check Relay Continuity Status' is overlaid on the image.</p> </div> <p style="text-align: center;">9-7</p>



Layout A



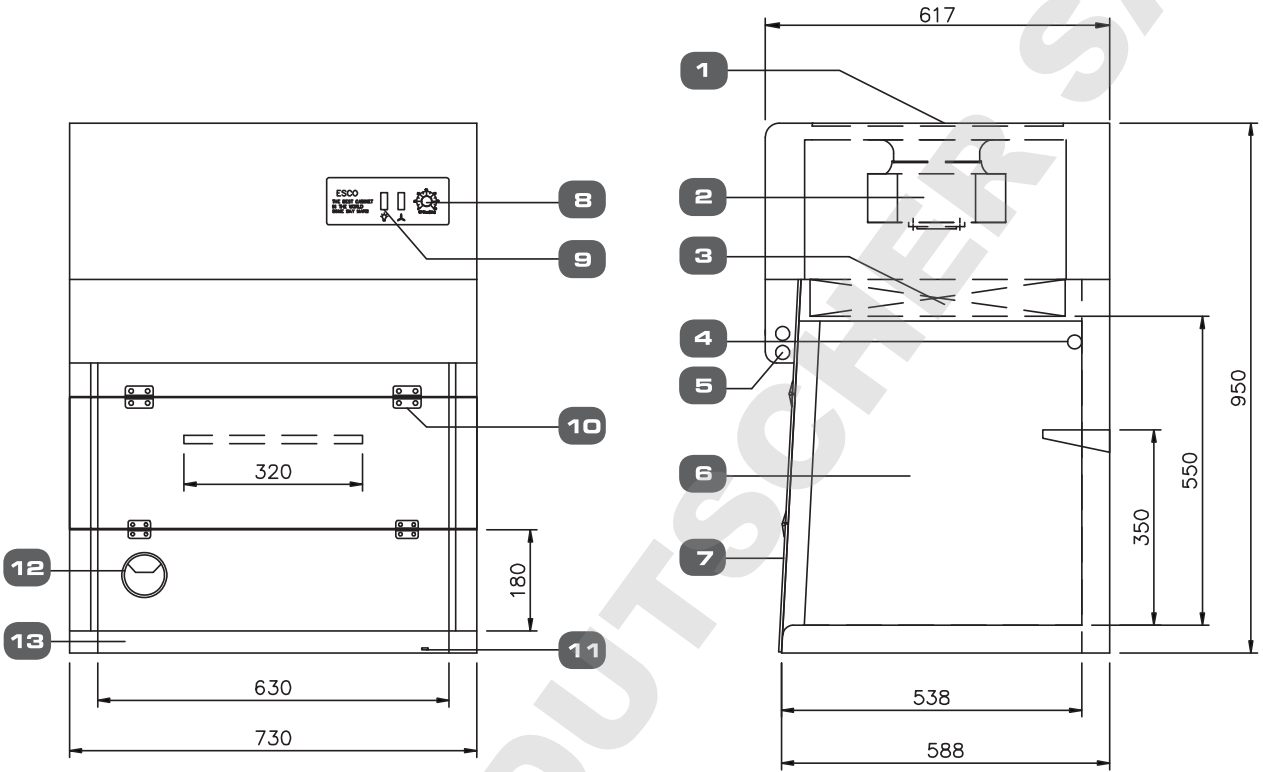
Layout B



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CHAPTER 3 Product Specification

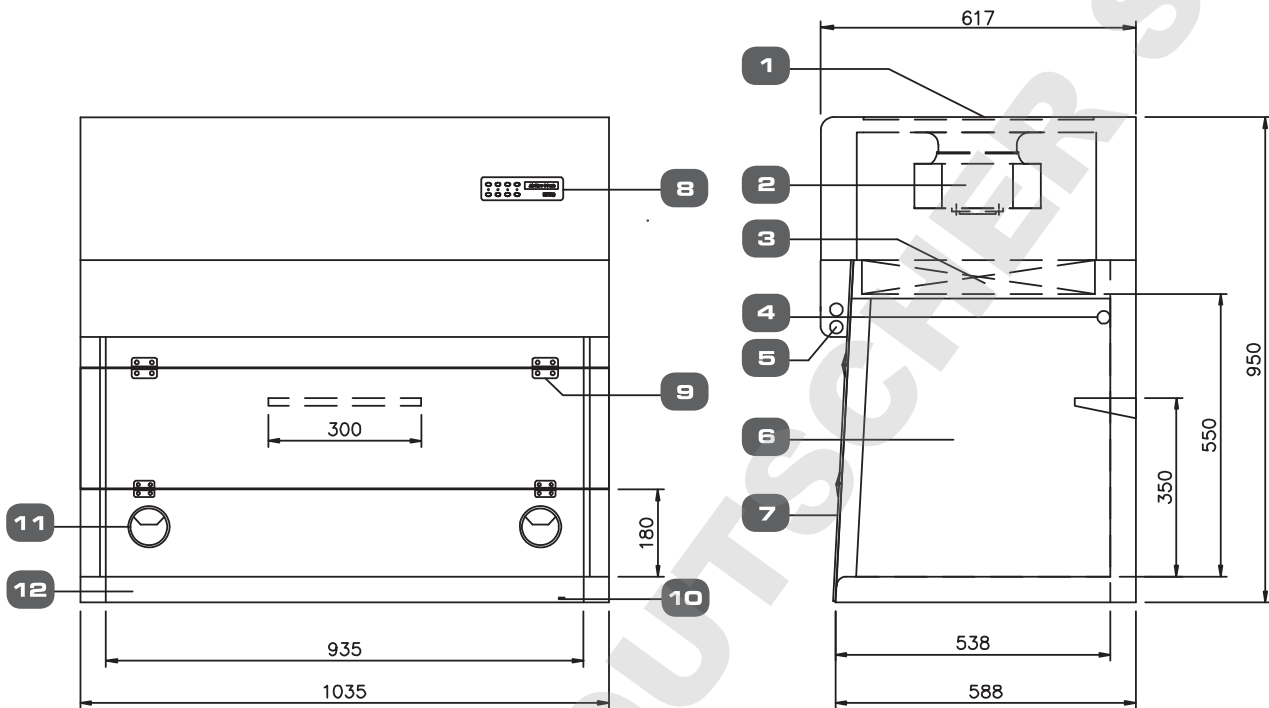
3.1 SCR Engineering Details



1. Pre-Filter
2. EBM-280 Blower
3. ULPA Filter
4. UV Lamp
5. Fluorescent Lamps
6. Tempered glass side panel
7. Hinged windows, polycarbonate
8. UV Timer
9. Operating switches
10. Spring-loaded hinge
11. UV interlocking switch
12. Pass through flap
13. Stainless steel work top with curved edge

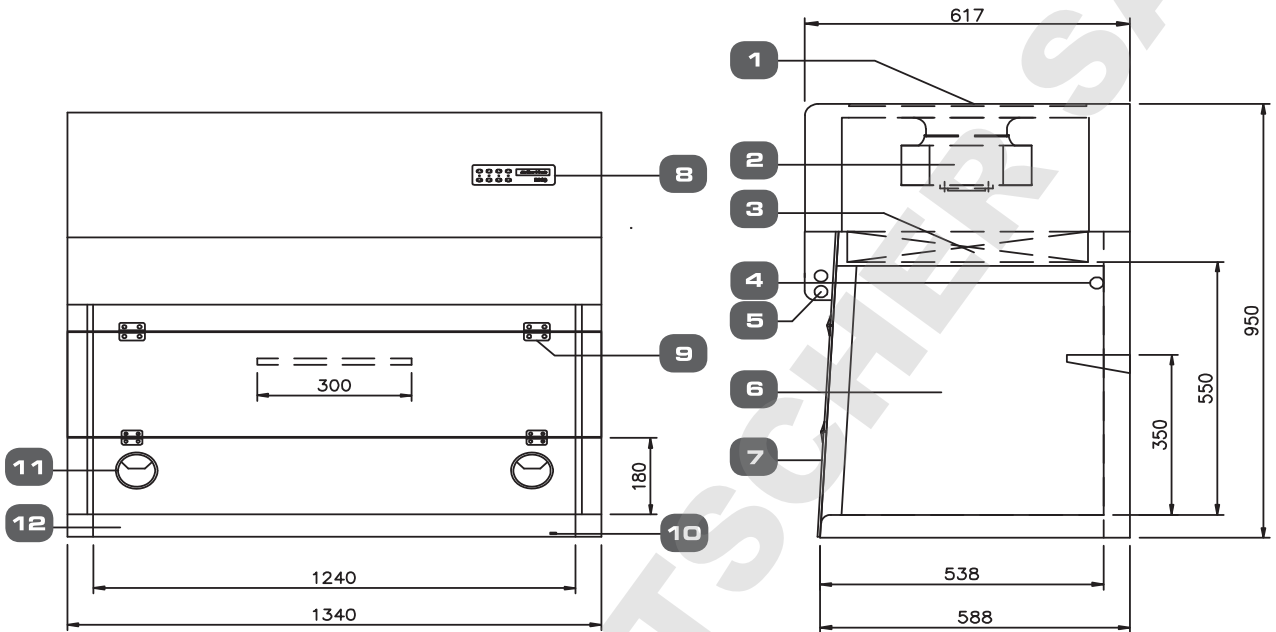
3.2 PCR Engineering Details

3.2.1 PCR-3A_



1. Pre-Filter
2. EBM-280 Blower
3. ULPA Filter
4. UV Lamp
5. Fluorescent Lamps
6. Tempered glass side panel
7. Hinged windows, polycarbonate
8. Microprocessor controller
9. Spring-loaded hinged
10. UV interlocking switch
11. Pass through flap
12. Stainless steel work top with curved edge

3.2.2 PCR-4A_



1. Pre-Filter
2. EBM-280 Blower
3. ULPA Filter
4. UV Lamp
5. Fluorescent Lamps
6. Tempered glass side panel
7. Hinged windows, polycarbonate
8. Microprocessor controller
9. Spring-loaded hinged
10. UV interlocking switch
11. Pass through flap
12. Stainless steel work top with curved edge

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3.3 Technical Specification Summary Table

3.3.1 SCR

General Specifications, SCR Vertical Laminar Flow Cabinets		
<i>Note to customer:</i> Choose from the following options and specify option number when ordering, (e.g. SCR-2A1 for 220-240VAC 50HZ)		
Model	SCR-2A_	
External Dimensions (L x W x H)	730 x 617 x 950 mm (28.7" x 24.3" x 37.4")	
Internal Dimensions (L x W x H)	630 x 538 x 550 mm (24.8" x 21.2" x 21.7")	
Laminar Airflow Velocity	Average of 0.50 - 0.60 m/s (100 - 120 fpm)	
Pre-Filter	Washable polyurethane fibers with 85% arrestance	
Sound Emission	<64 dBA	
Fluorescent Lamps Intensity	>800 Lux (>75 foot candles)	
UV Lighting	253.7 nanometer 20-watt UV lamp	
Construction	Main Body	Electrogalvanised steel with white oven-baked epoxy powder-coated finish. Coated with Esco Isocide antimicrobial coating
	Work Zone	1.2mm (0.05") 18 gauge stainless steel grade 304
Shipping Dimensions, Maximum (L x W x H)	825 x 725 x 1120 mm (27" x 23.8" x 36.7")	
Shipping Volume, Maximum	0.67 m ³ (24 ft ³)	
Shipping Weight, Maximum	97 kg (214 Lbs)	
Electrical	Model	Voltage
	SCR-2A1	220-240V, AC, 50Hz, 1Ø
	SCR-2A2	110-130V, AC, 60Hz, 1Ø
	SCR-2A3	220-240V, AC, 60Hz, 1Ø

3.3.2 PCR

General Specifications, PCR Vertical Laminar Flow Cabinets			
<i>Note to customer:</i> Choose from the following options and specify option number when ordering.			
Model	PCR-3A_	PCR-4A_	
Nominal Size	0.9 meters (3')	1.2 meters (4')	
External Dimensions (L x W x H)	1035 x 617 x 950 mm (40.7" x 24.3" x 37.4")	1340 x 617 x 950 mm (52.8" x 24.3" x 37.4")	
Internal Dimensions (L x W x H)	935 x 538 x 550 mm (36.8" x 21.2" x 21.7")	1240 x 538 x 550 mm (48.8" x 21.2" x 21.7")	
Laminar Airflow Velocity	Average of 0.30 m/s (60 fpm)		
Pre-Filter	Washable polyurethane fibers with 85% arrestance		
Sound Emission	<53 dBA	<62 dBA	
Fluorescent Lamps Intensity	>975 Lux (>91 foot candles)	>1230 Lux (>114 foot candles)	
UV Lamp	253.7 nanometer 15-watt UV lamp	253.7 nanometer 30-watt UV lamp	
Construction	Main Body	Electrogalvanised steel with white oven-baked epoxy powder-coated finish. Coated with Esco Isocide antimicrobial coating	
	Work Zone	1.2mm (0.05") 18 gauge stainless steel grade 304	
Shipping Dimensions, Maximum (L x W x H)**	1130 x 730 x 1150 mm (37" x 23.9" x 37.7")	1420 x 730 x 1150 mm (46.6" x 23.9" x 37.7")	
Shipping Volume, Maximum**	0.95 m ³ (34 ft ³)	1.18 m ³ (42 ft ³)	
Shipping Weight, Maximum**	123 kg (271 Lbs)	140 kg (309 Lbs)	
Electrical*	220-240V, AC, 50Hz, 1Ø	PCR-3A1	PCR-4A1
	110-130V, AC, 60Hz, 1Ø	PCR-3A2	PCR-4A2
	220-240V, AC, 60Hz, 1Ø	PCR-3A3	PCR-4A3

* Additional voltages may be available; contact Esco for ordering information.

** Cabinet only; excludes optional stand.

	Cabinet Performance	Air Quality	Filtration	Electrical Safety
Standards Compliance	IEST-RP-CC002.2, Worldwide	ISO 14644.1, Class 4, Worldwide IEST-G-CC1001, Worldwide IEST-G-CC1002, Worldwide and other equivalent air cleanliness requirement	IEST-RP-CC034.1, Worldwide IEST-RP-CC007.1, Worldwide IEST-RP-CC001.3, Worldwide EN1822 (H 13), Europe	IEC 61010-1, Worldwide EN 61010-1, Europe UL-61010-1, USA CAN/ CSA 22.2 No. 61010-1

3.4 Environmental and Electrical Requirements

The clean bench has been designed to be used under the following conditions:

Environment Requirements		
	US	Europe / Asia / Australia
Situation	Indoor Use Only	
Relative Humidity	20% - 90%	
Altitude	Up to 2000 meters (6600 ft)	
Temperature	Temperature should be in between 18 degree C and 30 degree C (65 deg F and 86 deg F).	
Pollution Degree	2.0 *	

* Pollution degree describes the amount of conductive pollutants present in an operating environment. In Pollution degree 2, it is assumed that only non-conductive pollutants such as dust are present, except that occasional conductivity is caused by condensation.

Electrical Requirements		
	US	Europe / Asia / Australia
Power Rating	110-130 V AC 60Hz	220-240V AC 50Hz
Power Source	Dedicated with unobstructed access	
Maximum Voltage Fluctuation	+/- 2% of nominal voltage otherwise install a power stabilizer	
Installation Category	Category II **	
Surge Protection and UPS	Strongly recommended for better protection	
Leakage Current	All electrical outlets combined should not exceed 2.0mA	
Voltage dips & short interruptions immunity test	At the time of carrying out the 'Voltage dips & short interruptions immunity test', flickers were observed in the fluorescent light and UV light whenever the voltage dips and short interruptions were applied on the AC mains port of the cabinet. This condition got rectified automatically after the test. The cabinet is considered to meet performance criteria B in 'Voltage dips & short interruptions immunity test' based on the above observation.	

** Installation category (over voltage category) defines the level of transient over voltage that the instrument is designed to withstand safely. It depends on the nature of electricity supply and the cabinet's over voltage protection means. CAT II is a category used for instruments which can be plugged to a power point which is comparable to the public mains found in facilities such as hospitals, research laboratories and industrial laboratories. The expected transient over voltage in CAT II is 2500 V for a 230 V supply and 1500 V for a 120 V supply.

APPENDIX

DOMINIQUE DUISCHER SAS

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Replacement Parts List

The use of non-Esco parts and / or parts not supplied directly by Esco or our authorized distributors, including but not limited to spare parts, system components and / or system accessories, shall void all expressed or implied warranties.

A. SCR

NO	ITEM/CABINET MODEL	ITEM CODE	DESCRIPTION	QTY
MECHANICAL REPLACEMENT PARTS				
1	BLOWER			
	PCR-XA1/A3	EQR/EL-BLOWER-B	BLOWER B 230V	1
	PCR-XA2/A4	EQR/EL-BLOWER-B1	BLOWER B1 115V	1
2	FILTER			
	PCR-3A1/A2/A3/A4	EQR/SP-FTR57	FILTER NO. 57	1
	PCR-4A1/A2/A3/A4	EQR/SP-FTR58	FILTER NO. 58	1
3	TEMPERED GLASS			
	PCR-XA1/A2/A3/A4	EQR/GL-56	TEMPERED GLASS GL-56	1
ELECTRICAL REPLACEMENT PARTS				
1	ELECTRICAL MODULE			
	PCR-XA1/A3	EP-L	COMPLETE ELECTRICAL PANEL WITH SPEED CONTROL 230V	1
	PCR-XA2/A4	EP-M	COMPLETE ELECTRICAL PANEL WITH SPEED CONTROL 115V	1
1.1	SPEED CONTROL			
	PCR-XA2/X4	EQR/EL-KB-KBWC-15R	SPEED CONTROLLER 115V 5A	1
	PCR-XA1/A3	EQR/EL-KB-KBWC-26R	SPEED CONTROLLER 230 6A	1
1.2	BALLAST*			
	PCR-XA1/A2/A3/A4	EQR/EL-BAL-UNV-T8-IS	ELECTRONIC BALLAST	1
1.3	UV BALLAST			
	PCR-3A1/A3	EQR/EL-BAL-EBP15	UV BALLAST	1
	PCR-4A1/A3	EQR/EL-BAL-EBP30	UV BALLAST	1
	PCR-XA2/A4	EQR/EL-BAL-EBU120	UV BALLAST	1
1.4	RELAY*			
	PCR-XA2/A4	EQR/EL-REL-JQX110V	RELAY 10A/2POLE, 110V	1
	PCR-XA1/A3	EQR/EL-REL-JQX220V	RELAY 10A/2POLE, 220-240V	1
2	AIRFLOW ALARM AND CONTROL SYSTEM			
2.1	MEMBRANE			
	PCR-XA1/A2/A3/A4	EQR/EL-MC-06A	MEMBRANE A ESCO	1
2.2	MAINBOARD (For units manufactured from May 04 onwards)			
	PCR-XA1/A2/A3/A4	EQR/EL-MC-18	MAIN BOARD (C-SERIES)	1
2.3	RELAY BOARD			
	PCR-XA1/A2/A3/A4	EQR/EL-MC-19	5 RELAY BOARD (C-SERIES)	1
2.3.1	FUSE			
	PCR-XA1/A2/A3/A4	EQR/EL-FUSE-F5AL250V	5A QUICK ACTING F5AL250V FUSE	5
2.4	INTERFACE BOARD			
	PCR-XA1/A2/A3/A4	EQR/EL-MC-20	INTERFACE BOARD (C-SERIES)	1

2.5	LCD			
	PCR-XA1/A2/A3/A4	EQR/EL-MC-34	LCD MODULE	1
2.6	SMPS			
	PCR-XA1/A2/A3/A4	EQR/EL-MC-22	SMPS	1
3	FLUORESCENT TUBE			
	PCR-3A1/A2/A3/A4	EQR/EL-TUB-3F25W	FLUORESCENT TUBE 3FT	2
	PCR-4A1/A2/A3/A4	EQR/EL-TUB-4F32W	FLUORESCENT TUBE 4FT	2
4	UV TUBE			
	PCR-3A1/A2/A3/A4	EQR/EL-TUB-UV15F15W	UV TUBE 1.5FT	1
	PCR-4A1/A2/A3/A4	EQR/EL-TUB-UV3F30W	UV TUBE 3FT	1
5	CIRCUIT BREAKER			
	PCR-XA1/A3	EQR/EL-CB-3A	CIRCUIT BREAKER 3A	1
	PCR-XA2/A4	EQR/EL-CB-4A	CIRCUIT BREAKER 4A	2
6	MAGNETIC SWITCH (For units manufactured from Jan 05 onwards. Microswitch was replaced then.)			
	ADC-XB1/B2/B3/B4	EQR/EL-MC-BS2011-UL	MAGNETIC CONTACT WITH UL LOGO	4
7	MAGNETIC			
	ADC-XB1/B2/B3/B4	EQR/EL-MC-MAGNETIC	MAGNETIC 10X20X3.5MM THK, WITH 3 M TYPE	1

B. PCR

NO	ITEM/CABINET MODEL	ITEM CODE	DESCRIPTION	QTY
MECHANICAL REPLACEMENT PARTS				
1	BLOWER			
	SCR-2A1/A3	EQR/EL-BLOWER-3	BLOWER NO.3 230V	1
	SCR-2A2/A4	EQR/EL-BLOWER-4	BLOWER NO.4 115V	1
2	FILTER			
	SCR-2AX	EQR/SP-FTR-047	H13 FILTER NO. 47	1
3	TEMPERED GLASS			
	SCR-2AX	EQR/GL-56	TEMPERED GLASS GL-56	1
ELECTRICAL REPLACEMENT PARTS				
1	ELECTRICAL MODULE			
	SCR-2A1/A3	EP26	COMPLETE ELECTRICAL PANEL WITH SPEED CONTROL 230V	1
	SCR-2A2/A4	EP25	COMPLETE ELECTRICAL PANEL WITH SPEED CONTROL 115V	1
1.1	SPEED CONTROL			
	SCR-2A1/A3	EQR/EL-KB-KBWC-15R	SPEED CONTROLLER 115V 5A	1
	SCR-2A2/A4	EQR/EL-KB-KBWC-26R	SPEED CONTROLLER 230 6A	1
1.2	BALLAST			
	SCR-2AX	EQR/EL-BAL-UNV-T8-IS	ELECTRONIC BALLAST	1
1.3	UV BALLAST			
	SCR-2A1/A3	EQR/EL-BAL-EBP30	UV BALLAST	1
	SCR-2A2/A4	EQR/EL-BAL-EBU120	UV BALLAST	1
1.4	RELAY			
	SCR-2A2/A4	EQR/EL-REL-JQX110V	RELAY 10A/2POLE, 110V	1
	SCR-2A1/A3	EQR/EL-REL-JQX220V	RELAY 10A/2POLE, 220-240V	1
2	CONTROL SYSTEM			
2.1	TIMER			
	SCR-2AX	EQR/EL-TIMER-DKJ	TIMER WITH 14MM LENGTH SHAFT, 270 DEG	1
3	FLUORESCENT TUBE			
	SCR-2AX	EQR/EL-TUB-2F17W	FLUORESCENT TUBE 2FT	2
4	UV TUBE			
	SCR-2AX	EQR/EL-TUB-UV15F15W-C	UV TUBE , 1.5FT	1
5	MAGNETIC SWITCH			
	SCR-XA1/A2/A3/A4	EQR/EL-MC-B52011-UL	MAGNETIC CONTACT WITH UL LOGO	4
6	MAGNETIC			
	SCR-XA1/A2/A3/A4	EQR/EL-MC-MAGNETIC	MAGNETIC 10X20X3.5MM THK, WITH 3 M TYPE	1

DOMINIQUE DUTSCHER SAS

Further Information and Reference Materials

The following documents are available for download at www.escoglobal.com, in the Technical Support area. These documents have been selected as pertinent to this product and we would recommend that anyone operating the cabinet familiarize themselves with this information.

1. INTRODUCTION TO LAMINAR FLOW CABINET
2. ULTRAVIOLET LAMPS IN LAMINAR FLOW AND BIOLOGICAL SAFETY CABINETS
3. INVESTIGATION ON UV LEAKAGE FROM LAMINAR FLOW CABINETS

FILTRATION TECHNOLOGY

- *Introduction to Contamination Control and Cleanroom Technology*. 2000. Matt Ramstorp. Wiley-VCH. Weinheim.
- *Cleanroom Technology. Fundamentals of Design, Testing, and Operation*. 2001. Whyte.W. Wiley, West Sussex, England.
- *IEST-RP-CC001: HEPA and ULPA Filters*.2002. Institute of Environmental Sciences and Technology, Illinois, USA.
- *IEST-RP-CC007: Testing ULPA Filters*.2002. Institute of Environmental Sciences and Technology, Illinois, USA.
- *IEST-RP-CC021: Testing HEPA and ULPA Filter Media*.2002. Institute of Environmental Sciences and Technology, Illinois, USA.
- *IEST-RP-CC034: HEPA and ULPA Filter Leak Tests*.2002. Institute of Environmental Sciences and Technology, Illinois, USA.
- *BS EN 13091: Biotechnology. Performance Criteria for Filter Elements and Filtration Assemblies*. 2000. British Standards, UK.

CLEAN AIR TECHNOLOGY

- *ISO 14644: Cleanrooms and Controlled Environments*.2000. International Organization for Standardization, Switzerland.
- *IEST-G-CC1001: Counting Airborne Particles for Classification and Monitoring of Cleanrooms and Clean Zones*.1999. Institute of Environmental Sciences and Technology, Illinois, USA.
- *IEST-G-CC1002: Determination of the Concentration of Airborne Ultrafine Particles*.1999. Institute of Environmental Sciences and Technology, Illinois, USA.
- *IEST-G-CC1003: Measurement of Airborne Macro Particles*.1999. Institute of Environmental Sciences and Technology, Illinois, USA.
- *IEST-G-CC1004: Sequential Sampling Plan for Use in Classification of the Particulate Cleanliness of Air in Cleanrooms and Clean Zones*.1999. Institute of Environmental Sciences and Technology, Illinois, USA.

WEBSITES

1. www.escoglobal.com
Esco Micro Pte. Ltd.
2. www.nsf.org
NSF International
3. <http://www.osha.gov>
Occupational Safety and Health Administration, USA
4. <http://www.absa.org>
American Biological Safety Association
5. <http://www.cetainternational.org> and
<http://www.cetainternational.org/links.htm>
Controlled Environment Testing Association and Related Links

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