June 2021

ULTRASAFE® CLASS II BIOLOGICAL SAFETY CABINET

OPERATIONS AND MAINTENANCE MANUAL

bsi. ISO 9001:2015 Quality Management
Cert. no. FS604110

AES ENVIRONMENTAL

INDEX

1. INTRODUCTION

Thank you for your decision to purchase this UltraSafe® Class II biological safety cabinet manufactured by AES Environmental. Our desire to manufacture a robust, reliable and fully compliant product in Australia, coupled with the availability of improved manufacturing, engineering and production technologies, has resulted in the development of the UltraSafe® series.

The UltraSafe® series is specifically designed to comply with Australian Standard AS2252 Part 2 - 2009, that specifies all critical performance, safety and design requirements for Class II cabinets. Our choice to use the Australian Standards as a benchmark for our products provides our customers with the confidence and knowledge that they are indeed purchasing a reliable product.

AES laminar flow and HEPA filter products are manufactured in Australia. All stages of manufacture are subjected to rigorous checks to ensure that specified quality standards are maintained. HEPA filters are individually tested and certified for efficiency, integrity and pressure drop before installation in cabinets. Each cabinet undergoes stringent testing of filter installations, airflows and other performance aspects. A NATA- accredited factory laboratory using calibrated apparatus and test procedures conducts all tests.

Backed by a comprehensive warranty covering the quality and performance of materials and workmanship, UltraSafe® Series cabinets are designed to provide many years of safe operation.

Your investment in this cabinet and its vital contribution to laboratory safety should be protected by regular specialised inspection, testing and certification. AES maintains fully equipped field service laboratories in major Australian centres, New Zealand, Singapore, Indonesia, Malaysia and Thailand.

These laboratories provide comprehensive on-site commissioning, testing and certification services for any brand/model safety cabinets, laminar flow systems, cleanrooms and all HEPA filter installations.

2. CABINET APPLICATIONS, SELECTION AND LIMITATIONS

2.1 Applications:

Surveys have shown that a significant number of laboratory- acquired infections are due to exposure to aerosols that may be produced from common microbiology laboratory procedures. Aerosol containment techniques and facilities appropriate to the microorganisms being handled should be provided.

Australian Standard AS2252.2 defines biological safety cabinets as the primary barrier against exposure to airborne contamination.

2.2 Selection of cabinets and limitations:

2.2.1 General:

Class I and II biological safety cabinets are open-fronted, ventilated containment enclosures, intended for work with microorganisms classified in AS2243.3 as Risk Groups 2, 3 and 4, and which can be deactivated by formaldehyde on approved types of decontaminant.

Cabinets incorporate HEPA filters and variable-speed fans. They are self-contained work stations and operate independently of other air-handling systems.

The selection of cabinets should be based on the consideration of existing and possible future work programmes.

Class I cabinets should be specified for non-sterile work with such microorganisms.

Class II cabinets should be specified where sterility and cross-contamination control is needed in work involving the handling of potentially hazardous biological materials.

Although Class II cabinets can be used in 'Class I' applications, Class I cabinets cannot be converted to Class II specification.

2.2.2 Class I Cabinets:

Class I cabinets are 100%-exhaust enclosures with HEPA filtration of exhaust air and inward air velocity at the work opening of 0.5-0.8 m/s.

An inward flow of room air through the work opening sweeps aerosols generated during the work process into a two-stage filter system. Air is directed into a pre-filter and a HEPA filter before being exhausted to the room.

Class I Cabinets provide personnel and environment protection, but do not protect products (materials within the cabinet).

2. CABINET APPLICATIONS, SELECTION AND LIMITATIONS (CONT.)

2.2 Selection of cabinets and limitations (Cont)

2.2.3 Class II Cabinets:

UltraSafe® Series Class II cabinets are part-recirculating laminar air flow enclosures with HEPA filtration of exhaust air and an air barrier at the work opening. Separate fan/HEPA filter systems are provided for exhaust and laminar air flow.

An inflow of room air into a full-width grille in the work opening creates an air barrier. HEPA-filtered vertical laminar air flow, which is recirculated in the work zone, creates a biologically-clean work environment. The barrier air mixes with the recirculated Laminar flow air in a sump underneath the work surface, and is exhausted to the room via a HEPA filter.

Class II cabinets provide personnel, environmental and product protection.

2.2.4 Laminar flow cabinets:

Laminar flow work stations or cabinets, sometimes called 'clean benches', are horizontal or vertical flow clean work enclosures. Pre-filtered room air is supplied to the work zone via a HEPA filter in a non-turbulent laminar flow manner.

Laminar Flow Cabinets do not provide personnel or environmental protection, as aerosols from the work zone are directed towards the operator.

2.2.5 Radioactive and toxic materials:

Radioactive materials:

Work in safety cabinets involving radioactive materials requires careful consideration of the risks posed to personnel. The fitting of internal and/or external shielding to cabinets may be required. The National Health and Medical Research Council have published recommendations for handling such materials and relevant legislation exists in all States. AS2243.4 specifies safe practices and environments for work where sources of ionizing radiation are used.

Toxic materials:

Biological safety cabinets as specified in Australian Standards are unsuitable for use with cytotoxic drugs and other toxic chemicals as these materials cannot be deactivated by fumigation. Aerosols of the materials, which are recirculated within the cabinet, contaminate fans and internal plenums. Therefore, if used for handling such materials, cabinets suffer permanent contamination of internal surfaces. This precludes safe internal maintenance. Australian Standard AS2252.5 deals with requirements for cytotoxic drug safety cabinets.

3. CABINET OPTI0NS AND INSTALLATION

3.1 Options

Factory options available for the UltraSafe® Series cabinets are:

- Air tap.
- Floor stand manual
- Vacuum tap with microbiological filter.
- Exhaust discharge on left hand side, front or top.
- Gas tap with solenoid control.
- Electric floor stand
- Additional power outlet.
- Fumigation adaptor panels for work opening and exhaust

Although these options attract modest additional cost when supplied with a new cabinet, fitting of some items to installed cabinets can be very difficult and costly.

3.2 Installation

3.2.1 Location

Cabinets should be located in a clean, draught-free area, not subject to air turbulence from air conditioning inlets, room exhausts, personnel traffic and other sources. All windows should be fixed. Temporary loss of air barrier containment can be caused by air turbulence in front of Class II cabinets. Partitions to minimise effects from personnel traffic can be installed, and excessive velocities from room air inlets can be inhibited by regulating dampers and/or blanking or baffling.

3.2.2 Services

Electrical power and other reticulated services which are required for cabinet operation (such as gas and vacuum) should be provided at the cabinet installation site.

Significant fluctuations in electrical power supply may adversely affect the function of cabinet alarms and visual indicators. Conditioning of the power supply should be considered in locations where such fluctuation is experienced. External vacuum pumps require in-line filtration to provide microbiological isolation. The accessory vacuum tap on your UltraSafe® safety cabinet is factory-fitted with a replaceable 0.2um membrane filter.

Compliance with local regulations for services such as gas should be confirmed.

3.2.3 Exhaust Air Discharge

Clearance in the direction of exhaust discharge should be at least 40cm, in order to minimise airflow resistance, and to allow access for maintenance and testing of the cabinet exhaust HEPA filter installation.

4. NATA TESTING AND CERTIFICATION

Your new cabinet has been tested and calibrated in a NATA Accredited Laboratory. Using testing or measurement services accredited by NATA provides you with greater confidence in the laboratory's technical capability, and in the reliability of the test data they provide to you.

The laboratory that performed your test or calibration has been thoroughly evaluated and accredited by NATA as meeting the technical competence requirements of internationally recognized standard ISO/IEC 17025:2017 (which includes the management requirements of the ISO 9001:2015 standards).

Not all laboratories are NATA accredited so always look for the NATA logo and endorsement on your test reports or confirm the NATA accreditation of the laboratory. The specific tests, calibrations or measurements that the laboratory has achieved accreditation for can found on its Scope of Accreditation.

This document can be obtained from the laboratory itself or from NATA. The Scope of Accreditations can also be found in NATA's Annual Directory of accredited facilities or in the on- line Directory on NATA's website at www.nata.com.au Measurements and calibrations performed by NATA Accredited Laboratories are also traceable to Australia's national standards of measurement, and thereby to international standards.

NATA (National Association of Testing Authorities) is Australia's government endorsed accreditor and NATA endorsed test reports are widely recognized by many sectors of the Australian government and industry. NATA is also a signatory to the mutual recognition agreements of the International Laboratory Accreditation Cooperation (ILAC) and the Asia-pacific Laboratory Accreditation Cooperation (APLAC). This means that NATA endorsed test reports are accepted by many of Australia's trading partners in:

- Europe
- North America
- South Africa
- Asia Pacific region.

So your NATA-endorsed report gives you increased confidence in the data, combined with greater acceptance of your test results both within Australia and internationally.

4.1. General:

All testing procedures should be conducted in accordance with AS1807 and AS2252 Part 2, using calibrated apparatus.

4. NATA TESTING AND CERTIFICATION (CONT.)

4.2 Frequency

Cabinets are tested in the factory and further testing is recommended as follows:

i. After any electrical or mechanical maintenance.
ii. After filter replacement.
iii. After re-location.
iv. At least annually.
v. In special circumstances, such as a significant change in the work programme, Or where unsafe cabinet operation is suspected.

4.3 Pre-testing procedures

Mechanical maintenance and testing of used cabinets should only be conducted after disinfection of the work zone and decontamination of the cabinet by fumigation. See 2.2.1 above. If decontamination was performed by the user, the service organisation should be provided with written assurance that effective decontamination has been carried out.

All testing of cabinet airflows should be performed with the room ventilation system operating in the normal mode.

4.4 Tests relating to safety

AS1807 lists ten (10) tests that can be performed on biological safety cabinets, and most of these are applicable to installed cabinets. However, tests on Class II cabinets relating to personnel and environmental protection are limited to the following:

Exhaust HEPA filter integrity → Test method AS1807. 6
Air barrier containment → Test method AS1807.22
Work Zone Integrity → Test method AS1.. 7.5

4. NATA TESTING AND CERTIFICATION (CONT.)

4.5 Performance test requirements:

The Ultrasafe series is designed to be compliant with AS 2252.2 and by extension compliant with BS EN ISO 12469 and ISO 14644 and NSF49. The Australian Standards provide the basic operating parameters of the Ultrasafe BSC shown in Table

4.5.1 Table 1

Downflow velocity	The Down Flow Velocity (Laminar Velocity) is to be set at between 0.40 and 0.45 m/s
Exhaust Velocity	Typical exhaust velocities will be between 0.65 and 1.1m/s for a correctly functioning BSC depending on the installation location
Air Barrier Containment	The Ultrasafe uses the test methods contained in AS 1807.22 for determination of the work zone air barrier. This is a direct challenge test using a test aerosol and photometer. Please contact your local agent for further instruction.
Leak Test	The HEPA filters are tested for leakage. Test should be conducted with HEPA volumetric flow rates at or below 0.60 m/s but above 0.35 m/s for best results. 100% concentration can be sampled from the test tubes located below the sump area of the work zone and all screens are designed to be removable for accurate scanning.
Gas Tightness	The outer shell of the Ultrasafe shall be gas tight. This test should be performed immediately after installation on-site and can be subsequently performed after major works or movement. The cabinet is to be sealed and pressurised to 140 pa a soap solution is then used to determine if the out seals of the shell are gas tight

4. NATA TESTING AND CERTIFICATION (CONT.)

Work Zone Integrity	The integrity of the work zone is determined by utilising an aerosol source and photometer. The aerosol source is used to challenge the window frames and any other seals in the work zone.
Sound Level	Sound level should be no greater than 62 dbA on first installation or when new HEPA filters have been installed and 65 dbA at annual test intervals.
Lux Levels	Light levels in the work zone of the Ultrasafe shall be great than 650 lux and no point shall be lower than 400 lux.
UV levels	UV is determined to be effective at a rate of 400 mWm2 or greater.
Air Cleanliness	While not a specific test method, the air cleanliness within the work zone shall be a minimum ISO Grade 5

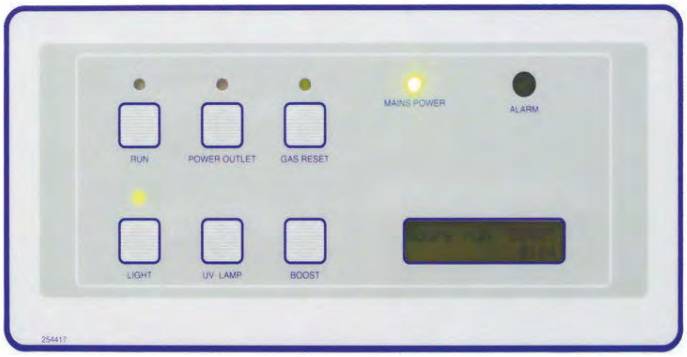
For further information on performing the above tests on-site please contact your local agent.

5. CONTROLS AND MONITORING SYSTEMS

5.1 General

Ultrasafe® Series cabinets are fitted with a purpose-designed, integrated electronic controller which incorporates function switches and indicators, system diagnostics, fan speed controllers, audible and visible alarms and a visual display panel (VDP).

Low voltage touch-control switches operate standard cabinet functions and optional gas and ultraviolet (UV) lamp services. Light-emitting diodes (LEDs) and an audible signal indicate the status of all switched functions. A micro-processor-based system continuously monitors five system conditions, with any malfunction shown in the VDP as an error message



5.2 Control Switches and Indicators

5.2.1 Description:

Switches are of the momentary touch-pad type with toggle operation. A short 'pip' sound accompanies any toggle operation. A short 'pip-pip-pip' sound accompanies any operation that has been ignored. LEDs
indicate the status of switched functions.

UV lamps and gas taps are optional fittings. On cabinets not fitted with these services, the relevant switch functions are not operative.

5.2.2 Switch functions and indicators

(i) 'RUN' switch for fans and operating modes:

This switch controls the laminar flow and exhaust fan systems A single actuation of the touch pad turns the fans on and off.

AUTOMATIC BOOST MODE:

If the viewing window is opened when the cabinet is running, a boost mode, which activates maximum airflow and the alarm system, is automatically selected. In this mode, the VDP displays the message 'WARNING! WINDOW OPEN', the audible alarm sounds and the 'ALARM' LED flashes. This mode is cancelled by closing the windows.

5. CONTROLS AND MONITORING SYSTEMS (CONT.)

5.2.2 Switch functions and indicators (cont.)

(i) 'RUN' switch for fans and operating modes(cont.)

DELAYED SWITCH-OFF MODE:

Actuation of the touch pad for 3 seconds or longer selects the post-use over-run or 'delayed-automatic-off' (DAO) mode. The fans and fluorescent lamps will automatically switch off after a pre-set period of 10 minutes. In this mode, the VDP counts down the minutes during the DAO period.

(ii) 'LIGHT' switch for fluorescent lamps:

This switch controls the fluorescent lamps, which provide work zone illumination. Operating this switch when the optional UV lamp is on, toggles the UV to off.

(iii) 'POWER OUTLET' switch for work zone power outlet(s):

This switch provides remote control of the standard splash-proof, general-purpose power outlet (GPO) and optional additional GPOs in the work zone.

(iv) 'UV LAMP' switch for UV lamp:

This switch controls the optional germicidal UV lamp which is fitted to enhance work zone sterility. The UV lamp can only be switched on when the cabinet is not running. Operating this switch when the fluorescent lamps are on will toggle the fluorescent lamp to off.

(v) 'GAS RESET' switch for optional gas tap:

This switch re-establishes supply of gas to the optional gas tap if the solenoid safety valve has interrupted supply of gas to the tap. The optional gas tap is connected via a solenoid valve, which cuts off gas supply to the tap if the cabinet has been turned off or if mains power supply has been interrupted.

(vi) 'BOOST' switch:

This switch enables manual selection of the maximum-exhaust boost mode, which is automatically activated by opening the window with the cabinet running. In this mode, the VDP displays the message 'BOOST MODE'. This switch has a toggle function between the boost mode and normal operation. The boost mode is cancelled by momentarily touching the switch.

(vii) 'RUN TIME' display panel (VDP):

The VDP operates in the default mode as an hour-meter (elapsed hours meter) when the cabinet is connected to mains supply and when no error condition exists, or non-standard mode is selected. See 5.2.3 below.

(viii) 'ALARM' LED and audible alarm:

Thee hour-meter cannot be reset by the user.

5. CONTROLS AND MONITORING SYSTEMS (CONT.)

5.2.3 VPD display messages

5.2.3.1 Description

In the default mode, the VDP functions as a hour-meter, which displays total elapsed running hours. If there is an identified malfunction in the conditions monitored by the controller, the VDP displays an error message, and the alarms are activated. The VDP also displays a message to indicate the selection or activation of a special mode. A latched error condition can be cleared by the actuation of any touch pad. Clearing of any error resets the controller to the default condition.

5.2.3.2 Error messages:

a. A reduction in exhaust airflow will generate the error message 'ERROR!EXHAUST LOW'. Full exhaust fan speed is selected, the laminar flow fan speed is maintained, the optional gas supply is shut off and the alarm is activated.

b. A reduction in laminar airflow will generate the error message 'ERROR!MAIN LOW'. Full exhaust fan speed is selected, the laminar flow fan speed is maintained, the optional gas supply is shut off and the alarm is activated.

c. An increase in laminar airflow will generate the error message 'ERROR!MAIN HIGH'. Full exhaust fan speed is selected, the laminar flow fan speed is maintained, the optional gas supply is shut off and the alarm is activated.

d. Failure of the controller will generate the error message 'ERROR! CONTROL FAILURE' to signify a ROM or RAM error. The optional gas supply is shut off and the alarm is activated.

e. Mains power interruption with the cabinet running will generate the error message 'ERROR! POWER FAILURE'. The optional gas supply is shut off and the alarm is activated. To reset press 'boost' button twice.

5.2.4 Mains supply and default mode operation:

On connection of mains power to the cabinet, the 'MAINS POWER' LED is illuminated and the following default conditions are set:

a. Power outlet control to off.
b. Optional UV control to off.
c. Fluorescent lamps to off.
d. Boost mode selector to off.
e. Fan control to off.
f. Gas supply is off.
g. The VDP display operates in the default mode and displays the total elapsed running hours of the cabinet and the message 'POWER ON'.
h. The controller is not in an error mode.

5. CONTROLS AND MONITORING SYSTEMS (CONT.)

5.2.5 Alarm

The alarm system provides audible and visual indication of operating system malfunctions.

The audible alarm and the 'ALARM' LED are activated by pressure sensors in the exhaust and laminar flow filter plenums. Any significant variation in airflow will produce a change in plenum pressure. This will activate the alarm.

If the viewing window is opened when the cabinet is running, a boost mode which activates maximum exhaust airflow and the alarm system is automatically selected. In this mode, the VDP displays the message 'WARNING! WINDOW OPEN', the audible alarm sounds and the 'ALARM' LED flashes.

The alarm will also be activated if an error condition was pending on initial start-up, if mains power supply is interrupted while the cabinet is running, or in the event of failure of the controller.

The cabinet should not be used until any identified fault is rectified.

5.2.6 Manometer

A Pressure gauge mounted on the rear work zone panel monitors the pressure differential between the laminar flow and exhaust filter plenums. This gauge is of the 'centre-zero' type, and acts as a pressure-balance indicator.

During testing to determine effective air barrier containment and the specified average laminar flow velocity, careful and progressive adjustment of the laminar flow and exhaust fan speed controllers is necessary in order to achieve an airflow balance between the two fan/filter systems.

Typically, the final settings for the laminar flow and exhaust fans produce a higher pressure in the exhaust filter plenum than in the laminar flow filter plenum. The Pressure gauge indicates this difference.

Any subsequent change in exhaust and/or laminar airflow will produce a change in the indicated pressure differential. After the final adjustment of the fan speed controllers, the Pressure gauge pointer is set to the centre 'zero' position.

If, with the cabinet running, this gauge shows a significant movement from the centre 'zero' position, a malfunction is indicated, and the cabinet should not be used until the fault is rectified. Additional indication of the malfunction will be given by the other indicators and alarms.

5. CONTROLS AND MONITORING SYSTEMS (CONT.)

5.2.7 Fuses

The cabinet electrical system is protected by individual fuses on all switched circuits. The fuses are located on the power board inside the control panel.

The cabinet must be disconnected from mains supply before the control panel is opened.

5.2.8 Service Mode

Authorised service technicians are able to select a service mode which provides a diagnostics facility and enables various cabinet settings to be changed. These include the following:

a. Fan speeds.
b. Pressure switch settings.
c. Hour-meter ('RUN TIME') display
d. Isolation of fans for test procedures.
e. DAO time

5.3 Run mode stabilisation

When the 'RUN' switch is operated the fans are switched on and the pressure-sensing switches activated. The fans require approximately 20 seconds for it to develop normal operating pressure and airflow.

The main (laminar flow) fan is not started until the exhaust fan system has reached normal operating pressure. During this period, the alarm is activated and the VDP displays the message 'WARNING! STABILISATION'.

6. WORK ZONE

6.1 Viewing Window

An internal mechanism operated by a gas strut closes and seals the viewing window without mechanical fasteners or catches.

To open the window, pull it firmly outwards. It will support itself in the open position. To close the window, push it down towards the closed position. If the viewing window is opened when the cabinet is running, a boost mode, which activates maximum exhaust airflow and the alarm system, is automatically s

elected. In this mode, the VDP displays the message 'WARNING! WINDOW OPEN', the audible alarm sounds and the 'ALARM' LED flashes. When the window is fully open, the alarms may be muted (de-activated) to allow lengthy procedures such as cleaning to be conducted without the sound of the alarms. This mode is selected by selecting any touch pad.

6.2 Front grille

To remove the grille, lift it off the locating pins, which engage its underside.

6.3 Work tray

The work tray is designed to allow its partial rotation for cleaning within the cabinet with the cabinet running. After removal of the front grille, lift the leading edge of the work tray and rotate it so that its underside is exposed for cleaning. Removal from the cabinet is possible after removal of the front grille.

7. TECHNIQUES FOR EFFECTIVE CABINET USE

7.1 General

The function and limitations of cabinets should be clearly understood and should be covered in staff training programmes, as should techniques for effective use and cleaning. Cabinets are open-fronted enclosures and rely on stable, unimpeded airflows and good user technique in order to provide design levels of protection.

7.2 Protective garments

Cabinet users should wear suitable clothing, such as a continuous-fronted garment with adjustable or elasticised wrist closures. Front-buttoned laboratory coats are not recommended.

Thin protective gloves are required for some work.

7.3 Use of the cabinet:

7.3.1 Pre-use Checks

a. Check the test label or certificate to ensure that it is less than 12 months old.
b. Check that the power supply is suitably connected.
c. Check that the exhaust air outlet is not obstructed.
d. Check that the viewing window is closed and free from obstruction.
e. Switch on the cabinet and check the operation of:
    i. The control panel VDP and indicator;
    ii. The fans and alarm systems;
    iii. The manometer, to ensure that the reading is in the normal range;
    iv. The fluorescent lamps;
    v. Any fitted services, such as gas or vacuum; and
    vi. The rear grille for any loose material.

7.3.2 Error messages:

a. Remove unnecessary items from the cabinet.
b. Wipe down the work zone surfaces with a suitable disinfectant. (See 8 below).
c. Run the cabinet for at least 5 minutes so as to clear away any residual aerosols.
d. If necessary, use plastics-backed, absorbent sheeting to reduce clean-up between procedures.
e. Plan work so as to place all materials in, or close to the cabinet and within easy reach of the operator. Use of a stainless-steel trolley for materials is recommended. Wipe down the external surface of all items of equipment with a suitable disinfectant before placing them in the cabinet.
f. Allow the cabinet to run for a further 5 minutes before use.

7. TECHNIQUES FOR EFFECTIVE CABINET USE (CONT)

7.3.3 Cabinet services

a. Bunsen burners should not be used in Class II cabinets as they may disrupt the laminar flow and barrier air. However, many users wish to use some form of gas burner. If routine use of a gas burner is required, the burner should be of the type, which has a pilot light, and only produces full flame on actuation of a touch control. Hose to connect gas supply inside the cabinet should be of the two-ply, reinforced type.
b. Hoses and power leads should not be introduced into cabinets through the work opening.
c. Reticulated vacuum services connected to cabinets should be microbiologically-isolated by means such as a membrane filter.
d. The optional vacuum tap on Ultrasafe cabinets are protected by a 50mm in-line 0.2um hydrophobic filter.
e. Centrifuges should not be operated in cabinets, but filling of tubes and the loading and unloading of buckets and rotors should take place within cabinets.

7.3.4 Techniques for cabinet operation:

a. Use good microbiological practice when working in the cabinet.
b. Avoid unnecessary hand and arm movements in and near the work zone can disrupt airflows.
c. Take care in busy laboratories to avoid cross-contamination between specimens. Disinfect work zone surfaces and allow the cabinet to run for at least 5 minutes to purge the cabinet and nearby area of residual aerosols.
d. At the end of the work, leave the cabinet running and conduct the following procedures:
    i. Transfer cultures to a container for storage or incubation.
    ii. Disinfect and remove all unnecessary materials to reduce the potential for cross-contamination and interruption of airflows; cabinets are not designed for protracted storage of materials.
    iii. Wipe the work zone surfaces with a fresh disinfectant solution.
    iv. Remove gloves for sterilisation or disposal as contaminated waste.
    v. Allow the cabinet to run for at least 5 minutes with manual switch-off or use of the DAO mode.
    vi. Fit the work opening cover.
    vii. The sump of Class II cabinets should be cleaned weekly, or after a spill.

7. TECHNIQUES FOR EFFECTIVE CABINET USE (CONT)

7.3.5 Breakdown Procedures

If the cabinet stops running, or develops a malfunction in a monitored system, the alarm system is activated. The following procedures should be followed:

a. Stop all work, securing all hazardous material.
b. Turn off all cabinet services, such as gas and vacuum.
c. Withdraw hands and wash with a disinfectant solution. Safely dispose of gloves.
d. Switch off the cabinet and fit the work opening cover.
e. Switch off power supply to the cabinet.
f. Mark the cabinet clearly as being unsafe for use.
g. Notify the supervisor or laboratory manager and call authorised service organisation.

7.3.6 Decontamination

1. Prior to maintenance or testing.
2. Prior to relocation.
3. When occupational health and safety requirements make it appropriate.
4. In special circumstances requiring increased assurance of preserving sterility.
5. After spillage where appropriate (see E.7.2).
6. As indicated by workload and nature of hazardous material being handled.

8. CLEANING AND DISINFECTION

When cleaning, a disinfectant should be determined according to the micro-organisms being handled in the cabinet. Surfaces must remain wet for the duration of the recommended contact time, after which the surface should be cleaned and left dry.

In the event of a spill of a clinical sample, a number of possible micro-organisms may be anticipated. Where corrosive disinfectants are used for some uncommon microorganisms, e.g. Creutzfeldt-Jacob Disease virus, chemical neutralisation is required to prevent corrosion of the cabinet surfaces.

AS2243.3 details the properties of common disinfectants and antiseptics. Some disinfectants and cleaning agents, although widely used in cabinets, present problems unless their limitations are understood and their use is controlled, e.g.:

a. Hypochlorite solutions can corrode stainless steel and wet residue of this material should not be left on cabinet surfaces.

b. Alcoholic solutions pose a fire hazard and should only be used sparingly and with the cabinet running.

c. Abrasive compounds may degrade stainless steel and painted surfaces.

d. Work-safe Australia has recommended revised work practices for the use of glutaraldehyde, now classified as a toxic chemical.

e. The grade and quality of stainless steel used in cabinet construction has a high degree of resistance to staining and corrosion, but may be degraded by the use of unsuitable cleaning agents.

9. HEPA FILTERS

HEPA filters, which arrest sub-micron particles, are the physical containment barrier in safety cabinets. They incorporate a very fragile filter medium which is easily damaged by physical contact and which may suffer degradation if splashed with liquid.

HEPA filters can not be cleaned and are normally replaced when their increased resistance to airflow impairs cabinet performance, when excessive leak repair is necessary, or when heavy surface contamination occurs.

Replacement filters should be suitable for use in critical applications and should be individually tested and certified in a NATA-accredited laboratory. Arrestance efficiency should be not less than 99.997% in accordance with AS4260. Additionally, filters should be certified for integrity (freedom from pin-hole leaks) in accordance with AS1807.6.

Determination of the in-situ integrity of HEPA filters and their installation is the most important testing procedure for cabinets. Cabinets with suspected filter damage should not be used until testing of filter integrity has been carried out.

10. UV LAMPS

Some Class II cabinets are ordered with an optional germicidal UV lamp fitted in the work zone, as shown below. The intended use and occupational health and safety aspects of UV should be understood by laboratory managers and cabinet users, i.e.

i. UV can be a useful adjunct to surface cleaning procedures, but should not be seen as a panacea that can replace good cleaning technique.

ii. UV lamps should be used for 20 to 30 minutes at the beginning and end of work programmes. They should not be left on for extended periods.

iii. Personnel should avoid exposure to UV radiation. Exposure may cause eye damage and erythema. Work opening covers should be in place whenever UV lamps are in use.

iv. Radiation intensity reduces over time due to degradation and external staining of lamps. Where the use of UV is a significant element of surface decontamination procedure, regular testing of lamp intensity and lamp replacement should be specified.

v. UV radiation degrades nitrile, plastics and rubber products and organic coatings, such as those used in typical cabinet construction.

11. WARRANTY AND REPLACEMENT PARTS

11.1 Warranty

This cabinet is protected by a 24-month warranty covering all materials, components and workmanship.

We will honour this warranty on advice to an AES branch or authorised distributor with full details of the cabinet, including date of purchase, serial number and the nature of the fault.

Items, which have a limited service life, such as fan motors, fluorescent and ultraviolet lamps and HEPA filters, are not covered in respect of normal degradation over time. Servicing of the cabinet by other than AES technicians or authorised service agents may wholly or partially invalidate the warranty.

11.2 Replacement parts

Only genuine AES replacement parts should be used in this cabinet. The use of non-genuine parts may significantly compromise the protection afforded by the cabinet and may invalidate the warranty.

Continuing 100% ex-factory availability of all replacement items is maintained. To obtain replacement parts, contact your nearest AES branch or distributor with the following information:

a. Full description of part(s).
b. Cabinet model.
c. Cabinet serial number.

11. WARRANTY AND REPLACEMENT PARTS

11.2 Replacement Parts (Cont.)

Cabinet Type	Cabinet Model no.	Part Numbers	Description	Qty.
Ultrasafe 90	1687-6000/90T 1687-6000/90L 1687-6000/90R 1687-6000/90F	753315	HEPA EXHAUST	1
		753329	HEPA LAMINAR	1
		1687-0544/1	G30T8 UV LAMPS	1
		1687-0540/4	FLURO COOLWHITE 900MM	2
		753345	Exhaust HEPA (Front Exhaust BSC Only	1
Ultrasafe 120	1687-6000/120T 1687-6000/120L 1687-6000/120R 1687-6000/120F	753315	HEPA EXHAUST	1
		753329	HEPA LAMINAR	1
		1687-0544/1	G30T8 UV LAMPS	1
		1687-0540/4	FLURO COOLWHITE 900MM	2
		1687-7182/332	Exhaust HEPA (Front Exhaust BSC Only	1
Ultrasafe 150	1687-6000/150T 1687-6000/150L 1687-6000/150R 1687-6000/150F	753315	HEPA EXHAUST	1
		753329	HEPA LAMINAR	2
		1687-0544/1	G30T8 UV LAMPS	1
		1687-0540/4	FLURO COOLWHITE 900MM	2
		1687-7182/332	Exhaust HEPA (Front Exhaust BSC Only	2
Ultrasafe 180	1687-6000/180T 1687-6000/180L 1687-6000/180R 1687-6000/180F	753315	HEPA EXHAUST	2
		753329	HEPA LAMINAR	1
		1687-0544/1	G30T8 UV LAMPS	1
		1687-0540/4	FLURO COOLWHITE 900MM	2
		1687-7182/332	Exhaust HEPA (Front Exhaust BSC Only	2

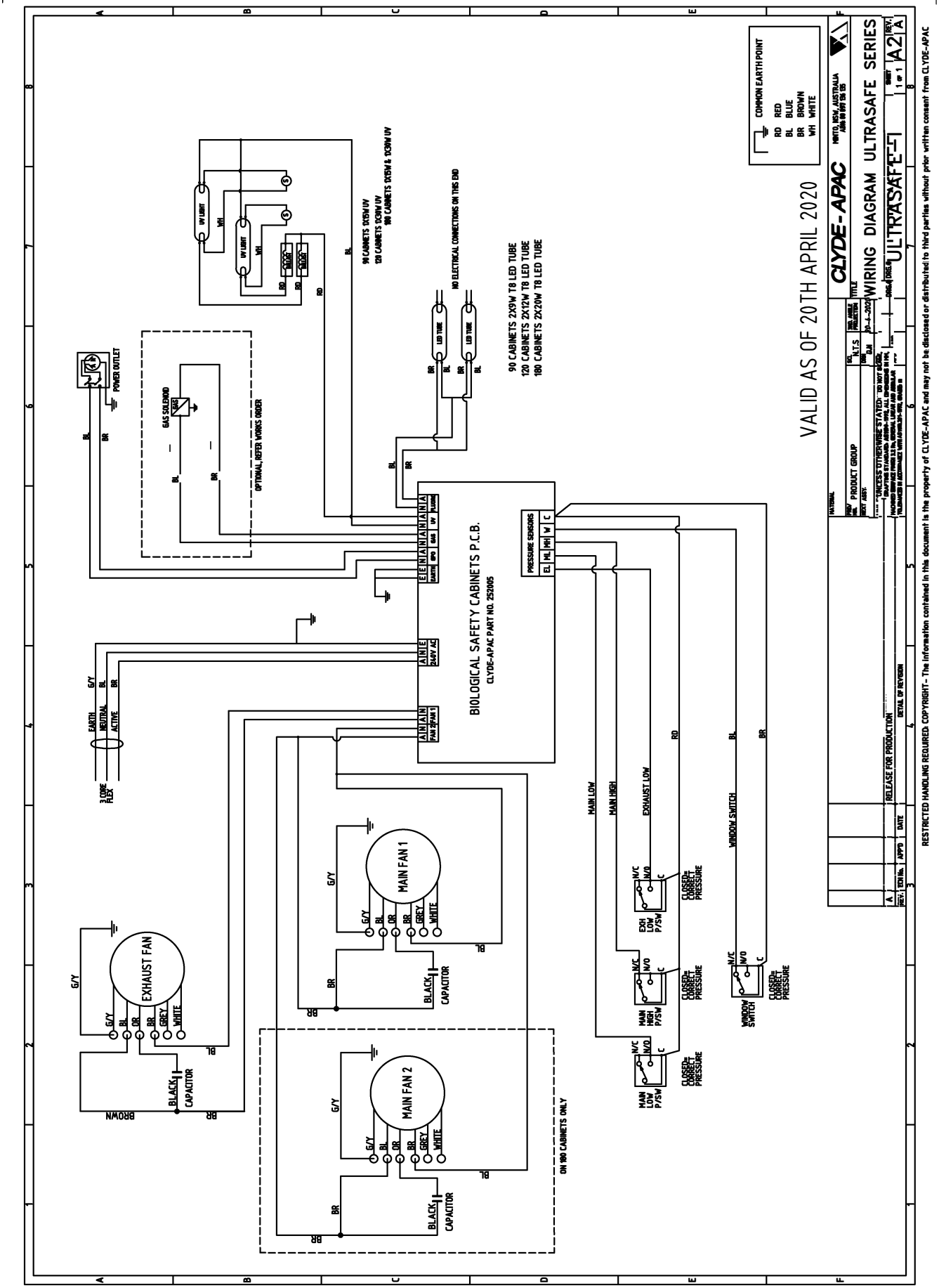
Other spare parts

The spare parts list below is standard for all ultrasafe cabinets

P/N	Description	QTY
1687-0530/11	Blower Suit 90, 120 wide BSC's	2
1687-0530/11	Blower Suit 150, 180 wide BSC's	3
252005D	Display Board Assembly	1
252005C	Power to Display Cable	1
252005P	Power Board Assembly	1
254417	Display Label Touch Pad	1
1687-0538/2	Pressure Switch	3

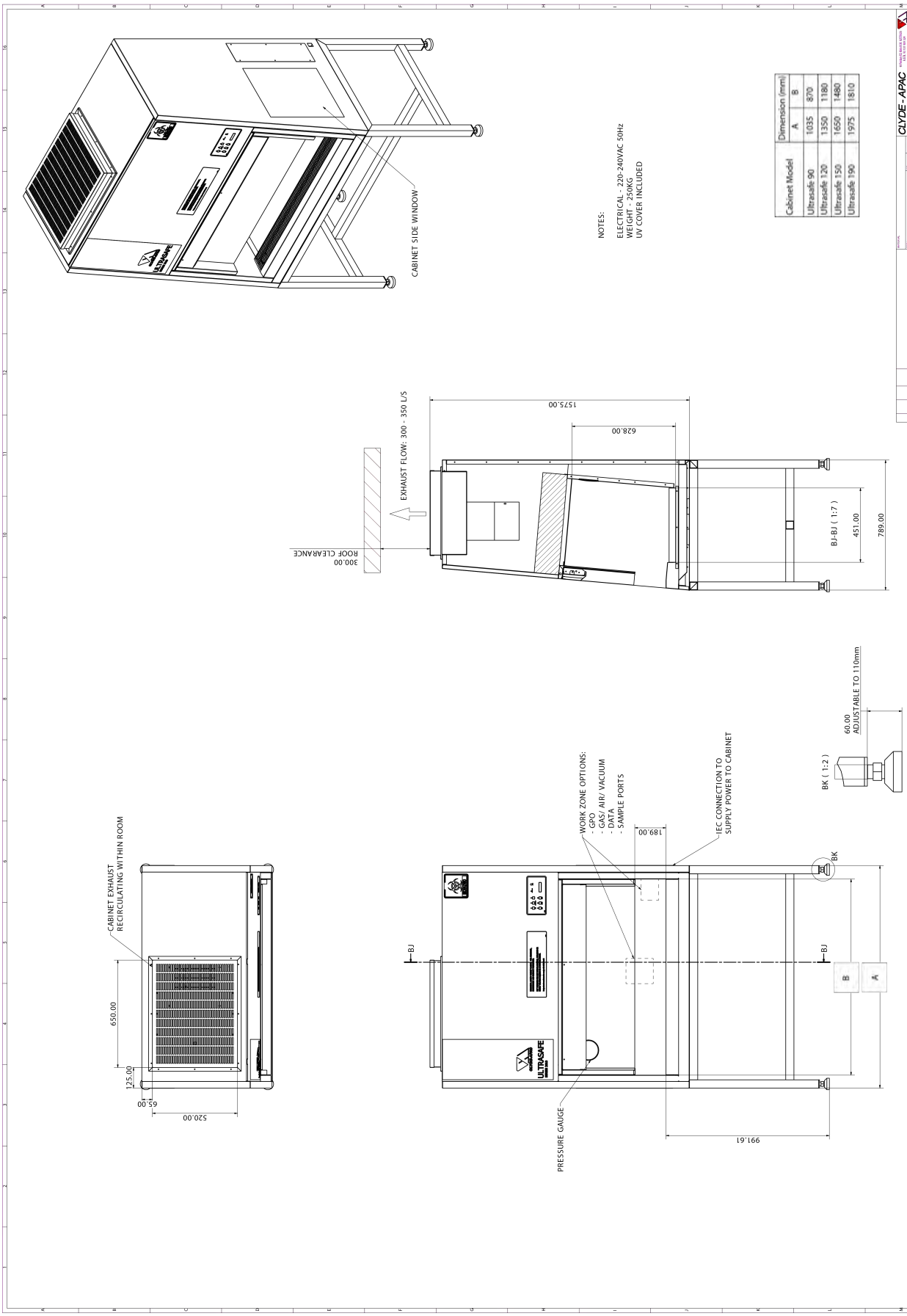
12. Appendix

12.1 Wiring and Cabinet Arrangement Diagrams

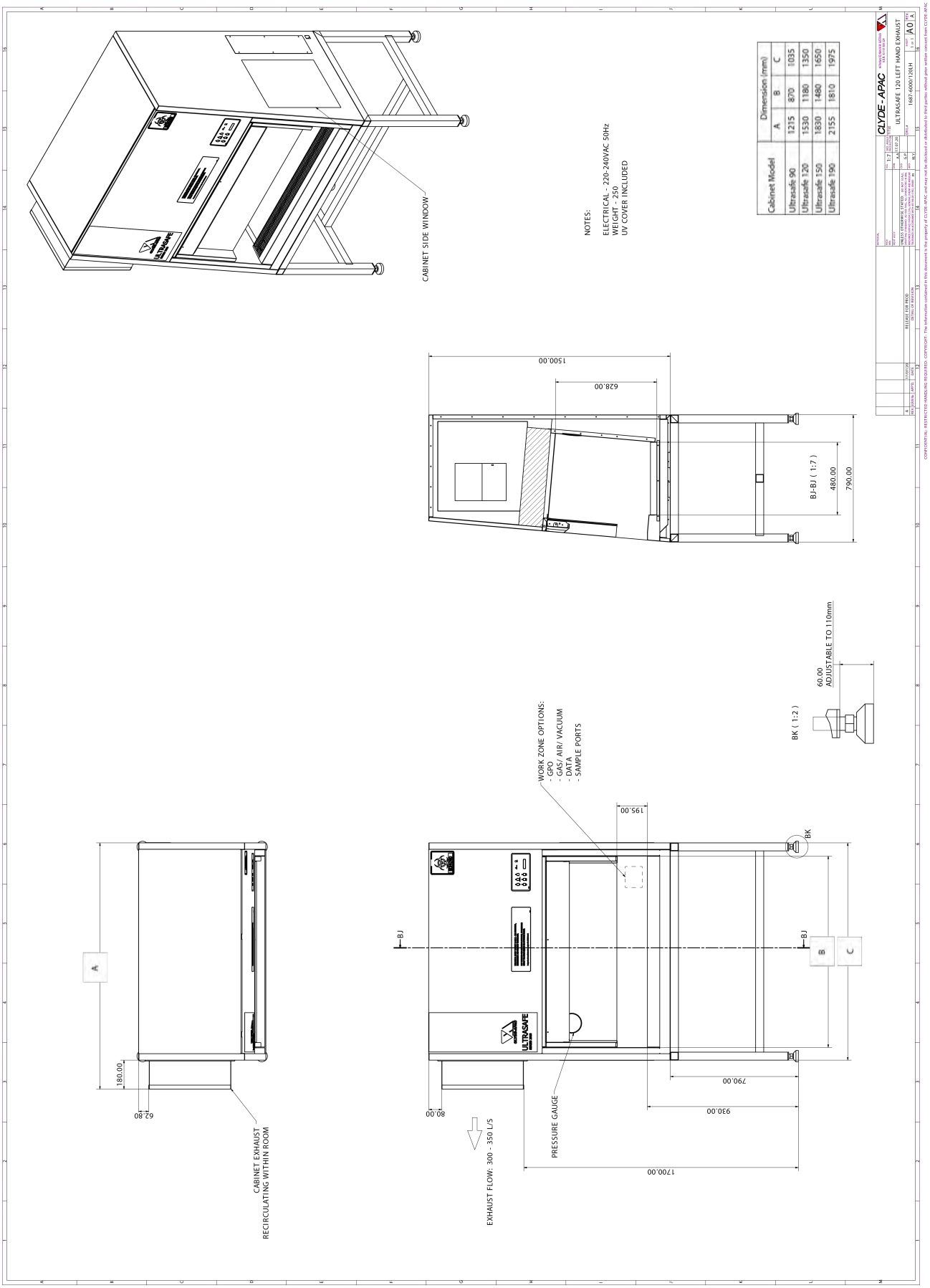


12. Appendix

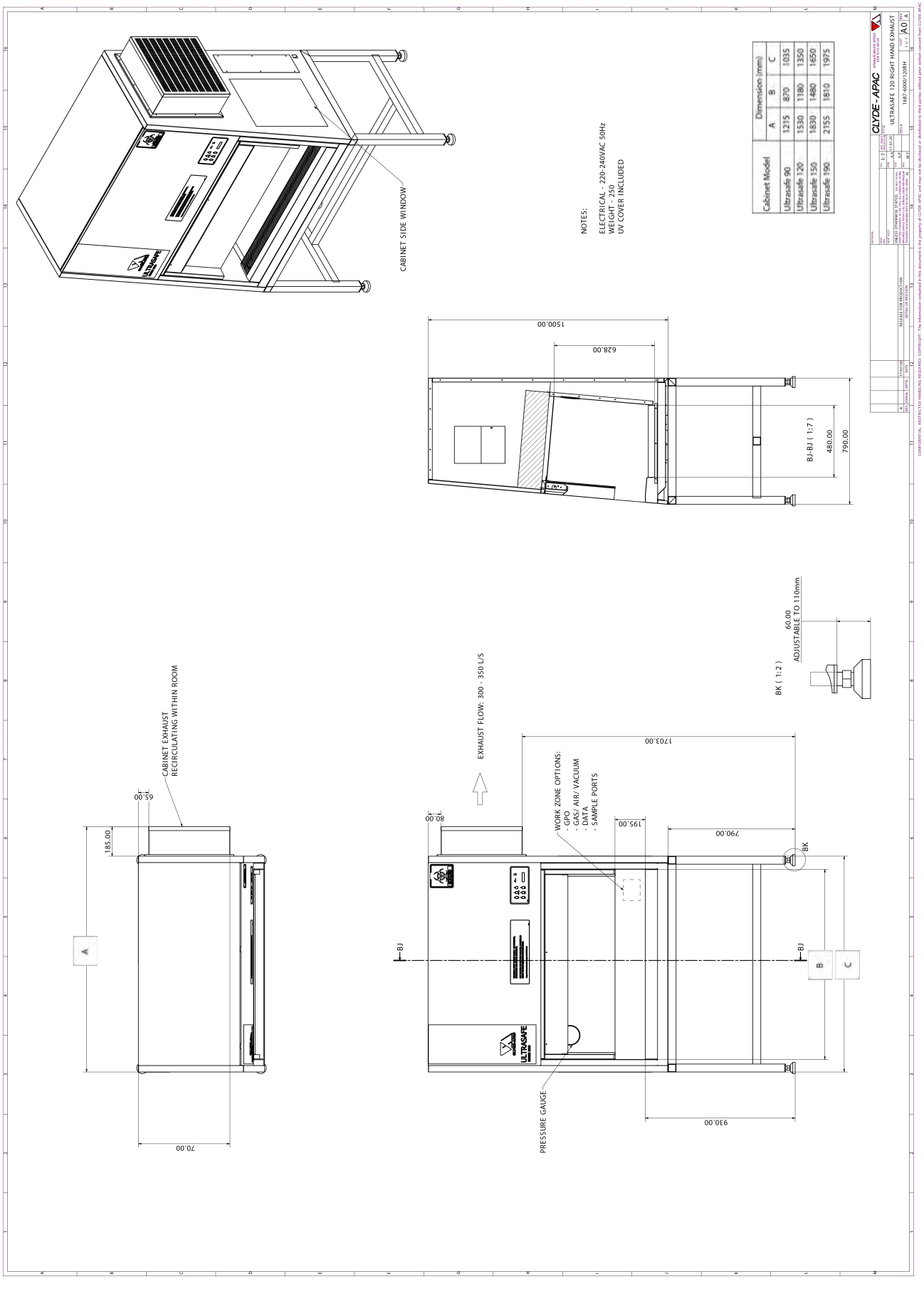
12.1 Wiring and Cabinet Arrangement Diagrams -Ultrasafe Top exhaust



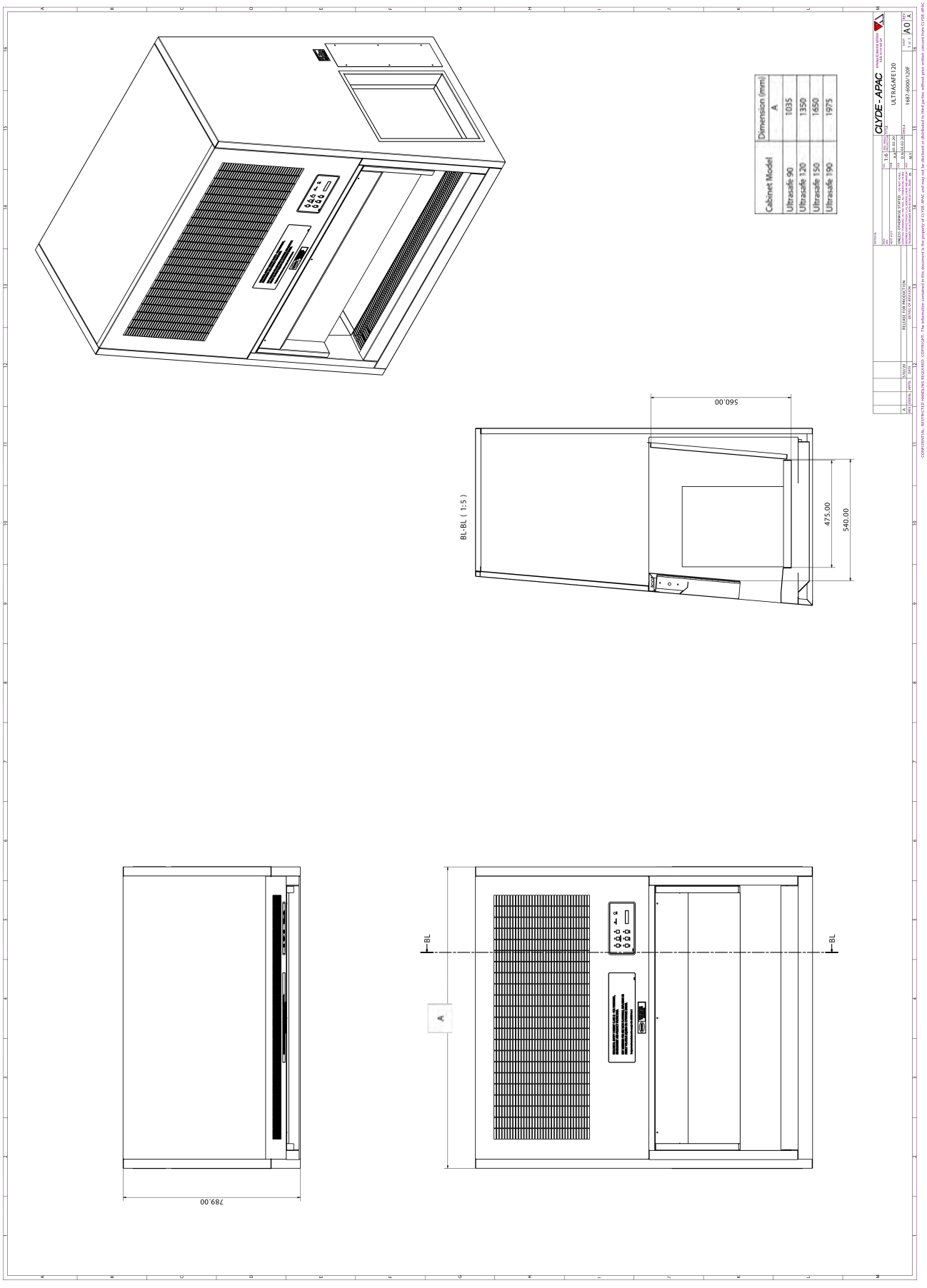
12.1 Wiring and Cabinet Arrangement Diagrams -Ultrasafe Left exhaust



12.1 Wiring and Cabinet Arrangement Diagrams -Ultrasafe Right exhaust



12.1 Wiring and Cabinet Arrangement Diagrams -Ultrasafe Front exhaust



bsi.

By Royal Charter

Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO 9001:2015

This is to certify that:

AMCCS Pty Ltd
trading as AES Environmental
9A Pembury Road
Minto NSW 2566

Holds Certificate Number: **FS 604110**

and operates a Quality Management System which complies with the requirements of ISO 9001:2015 for the following scope:

Design and manufacture of air filtration equipment, including biological cabinets, cytotoxic cabinets, laminar flow cabinets, electrostatic filters, HEPA (high efficiency particulate arrestance) filters and related special products.

For and on behalf of BSI:

Chris Cheung, Head of Compliance & Risk - Asia Pacific

Original Registration Date: 1993-06-21
Latest Revision Date: 2018-12-03

Effective Date: 2018-11-30
Expiry Date: 2022-02-28

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Air Barrier Containment

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[1]Institute of Medical and Veterinary Science, Adelaide, South Australia.
[2]Flinders University of South Australia
Faculty of Science and Engineering, ENGR4508 Engineering Honours Project

Abstract

The aim of this project is to investigate the various methods used indetermination air barrier containment of Biological Safety cabinets and validate their effectiveness. The Project's research showed that the aerosol test used in determination of the air barrier containment should be endorsed in the Australian standard as a valid method of testing.

Introduction

Biological safety cabinets have proven to be an essential item of equipments inside any research and or diagnostics laboratories. Our dependency on them has improved drastically. Cabinets are essential component in handling biological hazardous materials. It is the only mean of safety from getting infected with dangerous substance that contribute to a high death rate that can be prevented simply by just using proper biological safety cabinets. This research focused on the air flow inside the cabinet and how it could affect the air barrier at the sash of the cabinet. In addition to establishing a methodology of validating the Aerosol test.

Methods

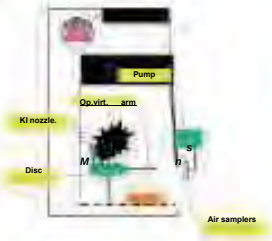
Test 1

- Setting up the cabinet according to the British standard.
- Test the cabinet using potassium Iodide Discus method. Examine the environmental factors that may affect the cabinet.

- Examine and observe the droplets affect of the KI.Examine and observe the droplets affect of the KI. scrutinize the effects of varying the velocity of the main fan motor and the exhaust fan motor on the performance of the air barrier and on the performance of the potassium iodide discus results. Investigate the operator protection factor.
- On the original setting of the cabinet in accordance to the British standard test the cabinet using the smoke generator test (the aerosol test). Examine the outcomes and correlate the results.
- Determine the differences and the similarities and determine if the test pass or fail. Enhance the photometer with the use of particle counter in order to achieve a quantitative results.
- Repeat the test with setting up a cabinet in accordance to the Australian standard then start to test it using the potassium iodide discus. Produce a graph of comparison of the suitable air velocity that could be used where both tests fails/ passes.
- Outline the findings in terms of performance and air velocities.

Test 2:

- Scattering effect around the cabinet.
- Use a die to observe the scattered potassium iodide around the cabinet.
- Is it sufficient to test the centre only?
- Move the sampler of the KI discus towards the side of the cabinet and carry out a test. Work out the operator protection factor at the new positions of the samplers.
- Correlate the results obtained versus the results obtained from testing at the centre only. Investigate the areas where the barrier is vulnerable.



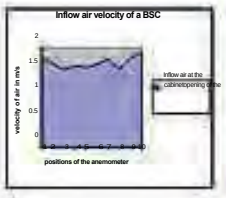
Test 3:

- Work out the centripetal force that the particles hitting the barrier with for both the KI discus method and the aerosol liquid method.
- For the KI discus method
- 38mm spinning disc (28,000 r/min) + nozzle delivering ***M***=20ml of 15g/l solution of KI, generating ***N*** particles
- Air samplers ***s***=100dm^3/min with 25mm filter membranes
- Count the spots on developed membranes: ***n***.
- Calculate A_{pf}:
  - with $N = 3.1 \times 10^7 \times M$
  - $A_{pf} = Ns/10^4 n$
- If $n = 62$, $A_{pf} = 1 \times 10^5$
- If $n = 1$, $A_{pf} = 6.2 \times 10^6$
- Correlate with the force of generating aerosol.

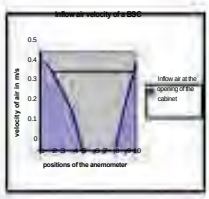
Results

Now at these optimum conditions

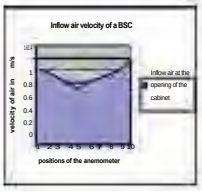
- Testing the inflow of the air across the opening of the cabinet using anemometer at 10 labelled spots, hence 50 mm from each sides of the cabinets then with in a spacing of 100 mm after the sides.
- Average air velocity of 1.7m/s



- By lowering the speed of the exhaust fan
- Average air velocity of 0.21 m/s



- By lowering the speed of the main fan
- Average air velocity of 1.12 m/s



Validation and Comparison Results

KI discus test | **Aerosol liquid test**

• The cost of the equipment	• Cheaper equipment multi-purpose
• The time taken to set up, and the general down time to the cabinet	• Short down time to the cabinet
• The use of low air velocity 0.3 m/sec	• Using adequate air velocity 0.4m/sec to 0.45m/sec
• The metal cylinder is fixed which doesn't represent the actual action of the operator	• Simulating operators movements
• The localised position of the samplers at the centre.	• Testing along the whole sash
• The droplet effects of un-evaporated KI	• Penetrations of smoke particles
• Particle size range from 4 to 10 µm	• Particle size consistent less than 0.3 µm
• No substance reference to OPF of 10^5	• Real time scanning

Conclusion

The Key factor or controller of the air barrier is the exhaust fan motor. The barrier is maintained proportionally to the adjustment of the exhaust fan as shown from the results. lowering the air velocity of the main fan interrupt the barrier, and raise the main issue of cross contamination inside the cabinet. From the comparison performed, Aerosol liquid test provide better qualitative method of testing the air barrier since it cover lots of aspects of practical informative method of test. KI discus test can not be carried out at any laboratory since it could contaminate the work in the actual laboratory. In contrast to aerosol test which doesn't interfere with the nature of work carried out in the laboratory.

Acknowledgement

- Miss Sherry Randhawa academic supervisor of the research
- .M.V.SEngineeringservicesdepartment
- Clyde-Apac for their contribution and providing us with the KI discus equipment as well as referred materials.

References

- Australian standard 2252.2.
- Australian standard 1807.26-2004
- Australian standard 1807.22
- IMVS, CTL , procedure manuals for mechanical testing.
- ESCO Global Co-operation, Singapore.
- Published article reviews on KI discus

NATA
ACCREDITED LABORATORY

National Association of Testing Authorities, Australia

(ABN 59 004 379 748)

has accredited

AES Environmental

Vokes Air Filtration Pty Ltd

following demonstration of its technical competence to operate in accordance with

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Jennifer Evans
Chief Executive Officer

Date of issue: 12 June 2020
Date of accreditation: 07 January 1975
Accreditation number: 1146
Site number: 1139

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