

Labculture•PLUS®



Labculture Plus Class II Biological Safety Cabinet,
Model LP2-4S_.

Class II Biological Safety Cabinets
The Safety Solution for Life Science Laboratories



ESCO
WORLD CLASS. WORLDWIDE.



Each cabinet is KI-Discus type tested for performance integrity.
Available in 1.2 and 1.8 meter models (4' and 6').
Shown with optional telescoping stand.



Main Features

- Reduced height profile and noise levels compared with Esco Labculture.
- The front sash is motorized for convenient one touch operation.
- Sentinel™ Gold microprocessor monitors airflow in real-time via temperature compensated sensors and conserves UV lamp life with unique timer function.
- The Accuflow microprocessor based speed controller maintains constant, stable airflow despite building supply voltage fluctuations.
- The angled front, narrow profile front grille, raised armrest and frameless sash creates an ergonomic work environment.
- ULPA filters (per IEST-RP-CC-001.3) are tested to a typical efficiency of >99.999% for 0.1 to 0.3 micron particles, better than HEPA filters.
- Unique Esco Dynamic Chamber™ plenum.
- Negative pressure plenum surrounds contaminated positive pressure plenum; no fabric bags are used.
- Include multi-piece tray components which lift and remove to provide easy access encourage surface decontamination and can be sterilized inside autoclave.
- Esco **ISOCIDE™** antimicrobial coating on all painted surfaces minimizes contamination.





Operator, Product and Environmental Protection

The Esco Labculture Plus Class II Biosafety Cabinet provides operator, product and environmental protection against Biosafety Levels 1, 2 and 3. This cabinet can be used for handling Biohazard Level 4, provided that the operator wears positive pressure suit.

Containment and Protection

- Inflow of room air enters the front air grille to establish operator protection; room air does not enter the work zone, preventing product contamination.
- Auto-purge holes located at the front side walls eliminate eddy currents and dead air pockets in the critical area behind the sash window.
- The ULPA downflow (supply) filter is tilted proportional to the cabinet front angle to direct more air forward to the front air grille.
- The inflow velocity, downflow velocity, air flow path, and intake geometry are precision tuned and tested to create an optimum air curtain on the front aperture; this curtain maintains personnel and product protection even in the unlikely event of a severe inflow or downflow imbalance that would compromise protection in a conventional cabinet.

Integrated Filtration System

Independent supply and exhaust filters provide 99.999% typical efficiency for particle sizes of 0.1 to 0.3 recommended practice for ULPA performance (USA), and EN 1822 for H14 performance (EU).

- ULPA filters (per IEST-RP-CC001.3), are tested to a typical efficiency of >99.999% for 0.1 to 0.3 micron particles;

these provide better filtration capability than conventional H13 HEPA filters that have a typical efficiency of >99.99% for 0.3 micron particles.

- Modern separator-less mini-pleat filter construction maximizes the filter surface area to extend filter life and eliminate possible filter media damage by thin and sharp aluminum separators used in conventional HEPA filter construction.
- The filter frame and media is constructed in accordance with EN1822 requirements for fire retardant properties.
- The supply ULPA filter provides ISO Class 3 (per ISO14644.1) clean air to the work surface in a gentle vertical laminar flow for product protection.
- The exhaust ULPA filter traps biohazard particles acquired from the work surface before air is exhausted to the room, offering personnel and environmental protection.
- The exhaust filter media is protected from mechanical damage by an integrated metal screen guard, which is absent from conventional HEPA filters.

Mini-pleat Separatorless Filter (left) vs. Conventional Aluminium Separator Filter (right)



Esco cabinets use Swedish Camfil Farr® mini-pleat filters without aluminum separators to increase filter efficiency, minimize the chance of leakage, and to prolong filter life. Filters include a lightweight aluminum frame for structural stability and elimination of swelling common to conventional wood frames.

Front Sash Assembly

- Motorized front sash allows fingertip operation.

- Integrated sash proximity contacts sense proper sash position, serve as an interlock for the UV lamp, and activate an alarm if the sash is improperly positioned.
- The magnetic switch eliminates the chance of wear and tear typical of a mechanical switch.
- The back of the sash can be easily cleaned by removing the sash track cover and swinging up the sash glass.

Blower Efficiency

The Labculture Plus blower system is designed for high performance operation, maximum energy efficiency and minimal maintenance.

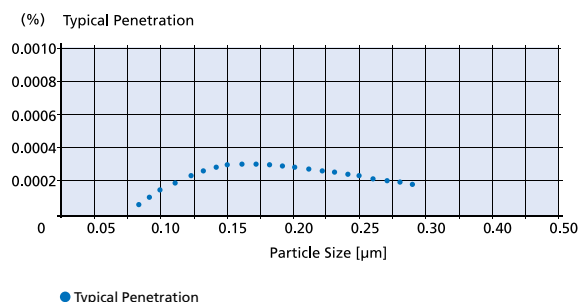
- The external rotor motor design allows for optimum cooling of the motor during extended operations and extends the motor bearing life.
- The permanently lubricated direct-drive external rotor motor/blower reduces operating costs.
- Built-in RFI and electrical noise filters eliminate interference with adjacent instrumentation.
- An integral blower hour meter tracks operating life for predictive maintenance planning.
- To prevent fan damage, a paper-catch grille traps papers or towels that may drop down on the drain pan, preventing them from being pulled into the column by fan suction.

Sentinel Microprocessor Control, Alarm, Monitoring System

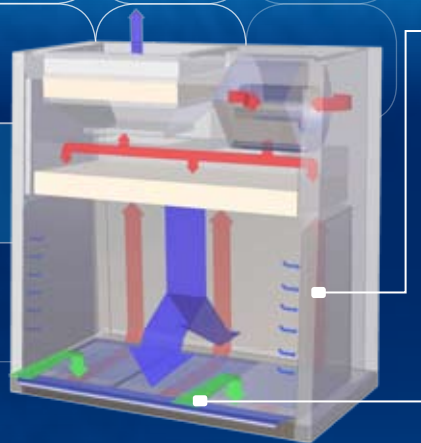
The Esco Sentinel™ microprocessor-based control system supervises operation of all cabinet functions.

- The control panel is located on the center of the cabinet, and angled down for easy access by the operator.

Esco ULPA Filter Efficiency



Esco cabinets use ULPA filters (per IEST-RP-CC001.3) instead of conventional HEPA filters commonly found in biological safety cabinets. While HEPA filters offer 99.99% typical efficiency at 0.3 micron level, ULPA filters provide 99.999% typical efficiency for particle sizes of 0.1 to 0.3 micron level.



Cabinet Filtration System

Side capture zones

Dynamic air barrier, inflow and forward-directed downflow air converge

- Ambient air is pulled through the perforations located towards the work zone front to prevent contamination of the work surface and work product. The inflow does not mix with the clean air within the cabinet work zone. Inflow air travels through a return path toward the common air plenum (blower plenum) at the top of the cabinet.
- Approximately 32% of the air in the common plenum is exhausted through the ULPA filter to the room. The remaining 68% of the air is passed through the downflow ULPA filter and into the work area as a vertical laminar flow air stream bathing the work surface in clean air.
- The uniform, non-turbulent air stream protects against cross contamination within and throughout the work area.
- Near the work surface, the downflow air stream splits with a portion moving toward the front air grille, and the remainder moving to the rear air grille. A small portion of the ULPA filtered downflow enters the intake perforations at the side capture zones at a higher velocity (small blue arrows).
- A combination of inflow and downflow air streams forms an air barrier that prevents contaminated room air from entering the work zone, and prevents work surface emissions from escaping the work zone.
- Air returns to the common air plenum where the 32% exhaust and 68% recirculation process is continued.

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- Continuous monitoring of cabinet airflow is displayed on a bright, easy-to-read LCD panel.
- Two integrated, temperature-compensated, true airflow velocity sensors provides an accurate airflow reading despite room temperature fluctuation.
- All electronic parts are contained inside a plug-and-play module that permits easy exchange if required.
- Microprocessor software updates are available from Esco for download via the Internet.

Sentinel functions are factory set to default to ON or OFF, depending on worldwide destination and local preferences. Default settings can be user activated through the touchpad data entry access.

- Automatic start-up sequence will prepare the cabinet for normal operation and advise when safe conditions are established.

- An administrator controlled PIN (Personal Identification Number) can be set to restrict access to main menu.
- The airflow alarm can be activated or deactivated depending on user preference and nature of the work.

Consult your Esco Operating Manual or contact your Sales Representative for information on user-preference programming capabilities built into the Sentinel microprocessor platform.

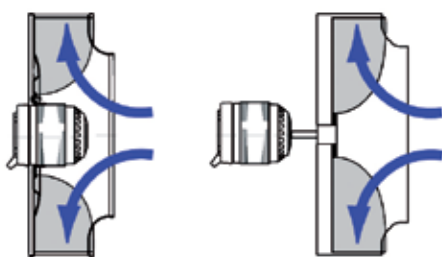
Cabinet Construction

Robust construction and enhanced safety features qualify the cabinet for the most demanding laboratory applications. The cabinet is fully assembled and ready to install and operate when shipped.

- The interior work area is formed from a single piece of stainless-steel with large radius corners to simplify cleaning.
- The cabinet work zone has no welded joints to collect contaminants or rust.

- All stainless steel work surfaces are accessible for cleaning.
- Tray components lift and remove to provide easy access and encourage surface decontamination.
- A recessed central area and stainless steel drain pan channels spills and prevent liquids from entering the lower filtration and blower systems.
- The drain pan is flush with the side walls to eliminate concealed or hard-to-clean spaces.
- There are no screws in on the front or sides to trap contaminants or complicate cleaning.
- Optional service fittings are offset for easier access.
- External surfaces are coated with Esco Isocide™ antimicrobial coating to protect against surface contamination and inhibit bacterial growth. Isocide eliminates 99.9% of surface bacteria within 24 hours of exposure.

Esco Centrifugal Fan with External Rotor Motor (left) vs. Conventional Fan with Standard Motor (right)



- Esco cabinets use German made **ebm-papst®** permanently lubricated, centrifugal motor/blowers with external rotor designs.
- Integrated blades narrow the profile and eliminate need for a motor shaft.
- Motors are selected for energy efficiency, compact design, and flat profile. The completely integrated assembly optimizes motor cooling.
- All rotating parts are unitized and balanced for smooth, quiet, vibration-free operation.

Comfortable Ergonomic Design

The LP2 cabinet is engineered for comfort, utility value and safety.

- The 5° angled viewing window and narrow profile front grille improves reach into the work area.
- The instant-start 5000k fluorescent lamp operates on an electronic ballast to reduce heat, improve comfort and conserve energy.

Touchpad data entry buttons permit control settings and access to diagnostics, default settings and hierarchical menus.

A graphical interface indicates cabinet performance.

Digital read-out with alpha-numeric display indicates all input, status and alarm functions.

All functions can be user activated through touch-pad programming access; see Operations Manual.

Color coded indicator lamps display green for primary function (fan operation); blue for secondary function (fluorescent lights and electrical outlet); and orange for caution (UV lamp ON).

Programmable automatic UV light timer simplifies operation, enhances contamination control, extends UV lamp life and saves energy.



Sentinel Microprocessor Control System, Programmable

- When programmed ON
 - the start-up sequence confirms status with Air Safe and local time display.
 - the Personal Identification Number (PIN) access restricts unauthorized adjustments.
 - an airflow alarm warns of deviations from normal velocities.

- The lamp delivers uniform lighting to the work surface for greater comfort, reduced glare and improved productivity; see Technical Specifications.
- The front armrest is raised above the workzone to improve comfort and to ensure that the operator's arms do not block the forward airflow perforations.
- The optional adjustable support stand provides work surface height control.
- The frameless sash eliminates operator's line of sight blockage.
- A generous sash opening allows for easier access into the work zone, provides ample room for transferring of small equipment.

- The sliding window can be fully opened to insert and remove larger instrumentation and equipment.

Electrical Safety and Certification

All components meet or exceed applicable safety requirements.

- Each cabinet is individually tested for electrical safety at factory.
- Documentation specific to each cabinet serial number is maintained on file.
- Certified to major world standards for biological safety cabinets, including the EN12469 (refer to Standards Compliance table on this page for the full list).

Warranty

The Labculture Plus cabinet is warranted for 3 years excluding consumable parts and accessories.

- Each cabinet is shipped with a comprehensive user's manual complete with a report documenting all test procedures.
- Additional IQ/OQ/PQ documentation is available upon request.
- Contact your local Sales Representative for specific warranty details or documentation requests.

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Robust Cabinet Construction and Enhanced Safety Features



Service fixtures are offset for easier reach. Standard cabinets include two fixture provisions on each sidewall (one provision on each sidewall for 0.9 meter/3 ft. cabinet). Electrical outlets are mounted below service fixtures to minimize obstructions.



- Helpful for certifiers, the hinged maintenance assembly opens to a fixed position on integrated, gas spring struts providing front service access.



- All key components, with the exception of the blower/motor assembly, are mounted outside the air stream and away from contaminated air to permit service without decontamination. These include fluorescent lamps, UV lamp, electrical harnesses, electronic boards and microprocessor control.
- Panels enclosing potentially hazardous areas or components such as microbiological contamination or electrical shock are color-coded red to warn service technician.
- The telescoping Dynamic Chamber™ plenum minimizes physical lifting and accelerates filter change when required.
- Work area containment is maintained even when removable components are lifted out for cleaning.

The drain pan is flush with the side walls to eliminate consealed or hard-to-clean spaces.

The lower drain trough is a single-piece fabrication with wide open angles and a channel to direct spills to the drain.

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Standards Compliance	Biosafety Cabinets	Air Quality	Filtration	Electrical Safety
	EN 12469, Europe	ISO 14644.1, Class 3, Worldwide JIS B9920, Class 3, Japan AS 1386 Class 1.5, Australia	EN-1822 (H14), Europe IEST-RP-CC001.3, USA IEST-RP-CC007, USA IEST-RP-CC034.1, USA	UL-61010-1, USA CAN/CSA-22.2, No.61010-1 EN-61010-1, Europe IEC- 61010-1, Worldwide

Dynamic Chamber™ Plenum Design



■ Negative pressure ■ Positive pressure

The Esco double-wall design creates a Dynamic Chamber plenum which surrounds contaminated areas with negative pressure, preventing the possibility of contamination from leaks in filter seal, gasket or cabinet structure.

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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.

Single Piece Work Tray

Available for applications where a sumped work surface is desired to contain spillage. Must be specified when ordering.

Support Stands

- Fixed height, available 711 mm (28") or 864 mm (34")
 - With leveling feet (± 38.1 mm /1.5")
 - With casters

- Adjustable height, hydraulic range 711 mm to 864 mm (28" to 34")
 - With leveling feet
 - With casters
- Telescoping height stand for leveling feet, nominal range 660 mm or 960 mm (26" or 37.8")
- Telescoping height stand for casters, nominal range 660 mm or 880 mm (26" or 34.6")
 - Adjustable in 25.4 mm (1") increments
- Cradle stand, electrical hydraulic, infinitely adjustable, with casters
 - Elevates to seating or standing work surface height.
 - When lowered permits movement through standard doorway.

Note: Increases exterior dimensions.

Electrical Outlets and Utility Fixtures

- Electrical outlet, ground fault, North America
- Electrical outlet, Europe / Worldwide
- Petcock (air, gas, vacuum)
 - North America (American) style
 - Europe / Worldwide style DIN 12898, DIN 12919, DIN 3537

Cabinet Accessories

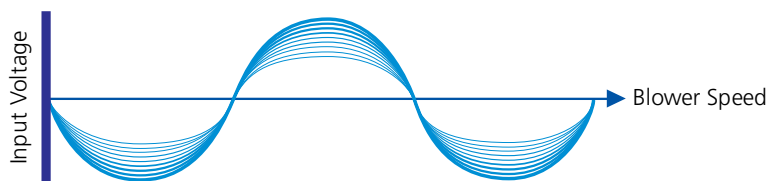
- PVC armrest
 - Chemically treated, improves operator comfort, easy-to-clean. 712 mm (28") standard size.
- Germicidal UV lamp
 - Controlled by automatic UV lamp timer through Sentinel micro-processor control panel.

- Emission of 253.7 nanometers for most efficient decontamination.
- Lamp is positioned away from operator line-of-sight for safety and proper exposure to interior surfaces.

Note: UV lamp intensity reduces over time and its effectiveness is subject to factors such as relative humidity in the cabinet, ambient air temperature and microbial species in the work zone.

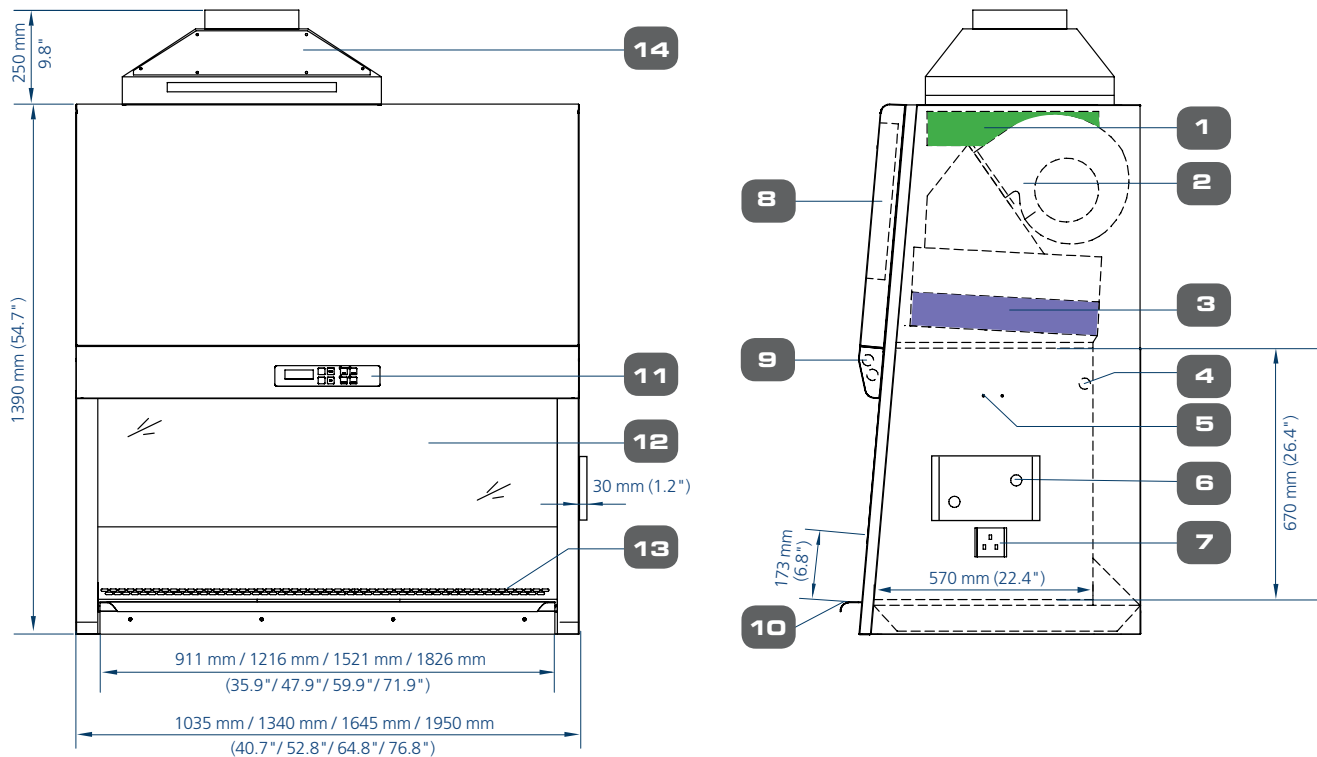
- Ergonomic lab chair
 - Laboratory grade construction, meets Class 100 cleanliness; alcohol resistant PVC materials
 - Adjustable 395-490 mm (15.6"-19.3")
- Ergonomic foot rest
 - Angled, helps maintain proper posture.
 - Adjustable height
 - Anti-skid coating, chemical resistant finish.
- IV bar, with hooks
 - Stainless steel construction
 - Available for all standard Esco cabinets.
- Solenoid valve
 - Interlocked via the microprocessor control system to shut off gas supply when the blower is off, sash at unsafe position or in case of an airflow alarm.
- Microscope viewing device
 - Mounting and viewing pouch integrated into sash. Factory installed; specify when ordering.

Esco Accuflow Microprocessor Speed Controller



The Esco Accuflow™ microprocessor speed controller maintains steady motor/blower speed despite building voltage fluctuations, thereby assuring constant face velocity and downflow for optimum safety, containment and protection.

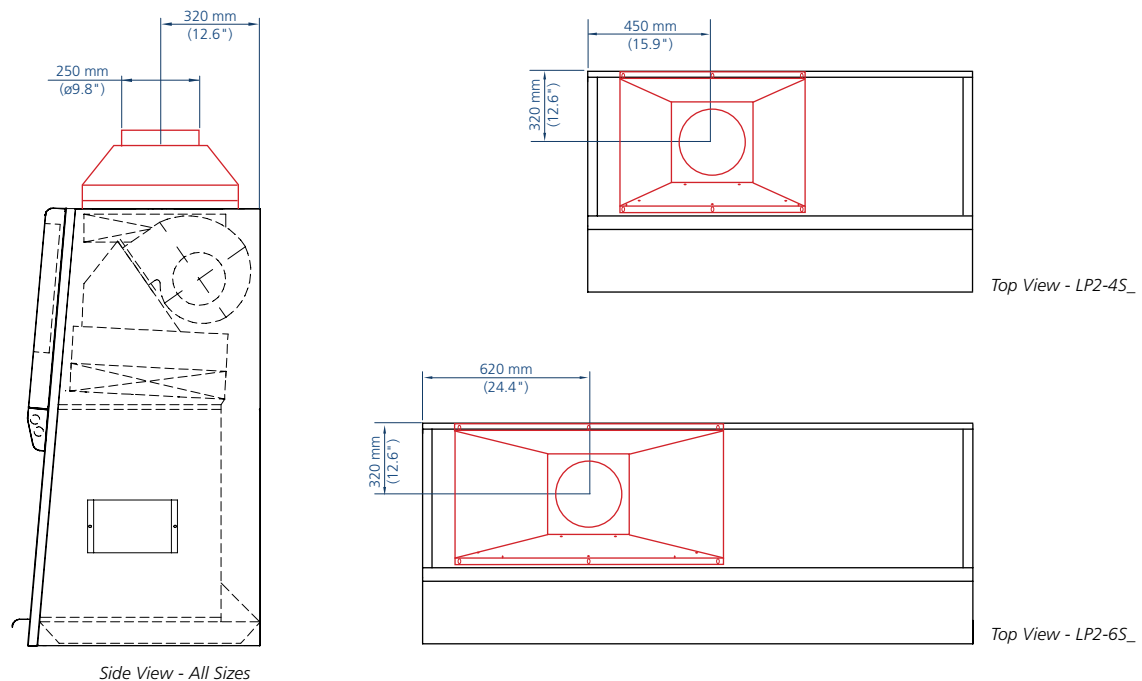
Model LP2 Biological Safety Cabinet Technical Specifications



- | | | |
|------------------------------------|---|---|
| 1. Exhaust filter, H14 | 6. Service fixture Retrofit Kit provision for gas, air and vacuum (Solenoid gas valve option) | 10. Stainless steel armrest |
| 2. Blower | 7. Electrical outlet Retrofit Kit provision (2 single outlet) | 11. Esco Sentinel microprocessor control system |
| 3. Downflow filter, H14 | 8. Electrical & Electronic Panel | 12. Motorised sash glass window |
| 4. UV light Retrofit Kit provision | 9. Fluorescent lamp | 13. Multi-piece stainless steel work surface |
| 5. IV-Bar Retrofit Kit provision | | 14. Exhaust collar (Optional) |

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Optional Exhaust Collar Positions for Thimble-Ducting for LP2 Models



General Specifications, Labculture Plus Biological Safety Cabinets (S-Series)

Note to customer: Insert electrical voltage number into last model number digit _ when ordering.

Model		LP2-4S_	LP2-6S_
Nominal Size		1.2 meters (4')	1.8 meters (6')
External Dimension (W x D x H)	Without Base Stand	1340 x 740 x 1390 mm 52.8" x 29.1" x 54.7"	1950 x 740 x 1390 mm 76.8" x 29.1" x 54.7"
	With Optional Base Stand, 711 mm (28") type	1340 x 740 x 2101 mm 52.8" x 29.1" x 82.7"	1950 x 740 x 2101 mm 76.8" x 29.1" x 82.7"
Internal Dimension (W x D x H)		1216 x 570 x 670 mm 47.8" x 22.4" x 26.4"	1826 x 570 x 670 mm 71.9" x 22.4" x 26.4"
Usable Work Area		0.54 m ² (5.8 sq.ft.)	0.83 m ² (9.0 sq.ft.)
Tested Opening		175 mm (7")	
Working Opening		200 mm (8")	
Average Airflow Velocity	Inflow	0.45 m/s (90 fpm)	
	Downflow	0.3 m/s (60 fpm)	
Airflow Volume	Inflow	341 m ³ /h (201 cfm)	512 m ³ /h (302 cfm)
	Downflow, 68%	722 m ³ /h (425 cfm)	1085 m ³ /h (640 cfm)
	Exhaust, 32%	341 m ³ /h (201 cfm)	512 m ³ /h (302 cfm)
	Required Exhaust With Optional Thimble Exhaust Collar	512 m ³ /h (301 cfm)	768 m ³ /h (452 cfm)
ULPA Filter Typical Efficiency		>99.995% for particle size between 0.1 to 0.3 microns per IEST-RP-CC001.3	
Sound Emission	NSF / ANSI 49	<63 dBA	<59 dBA
	EN 12469	<60 dBA	<56 dBA
Fluorescent Lamp Intensity		>1100 Lux (>102 foot candles)	>1100 Lux (>102 foot candles)
Cabinet Construction		Electro-galvanized steel with Isocide oven-baked epoxy-polyester powder coating	
		1.2 mm (0.05") /18 gauge	
Electrical*	220-240V, AC, 50Hz, 1Ø	LP2-4S1	LPS-6S1
	Cabinet Power/ Amp	700 W / 4 A	920 W / 5.2 A
	Outlet Amp Fuse	5 A	5 A
	Total Amp	9 A	10.2 A
	BTU/ Hr	1428	1877
	220-240V, AC, 60Hz, 1Ø	LP2-4S3	LP2-6S3
	Cabinet Power/ Amp	700 W / 4 A	920 W / 5.2 A
	Outlet Amp Fuse	5 A	5 A
	Total Amp	9 A	10.2 A
	BTU/ Hr	1428	1877
Net Weight **		234 kg / 516 lbs	304 kg / 669 lbs
Shipping Weight **		281 kg / 620 lbs	365 kg / 803 lbs
Shipping Dimensions, Maximum (W x D x H) **		1400 x 860 x 1750 mm 55.1" x 33.9" x 68.9"	2010 x 860 x 1750 mm 79.1" x 33.9" x 68.9"
Shipping Volume, Maximum **		2.11 m ³ (74.5 cu.ft.)	3.03 m ³ (106.9 cu.ft.)

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

** Cabinet only, excludes optional stand.



Personnel Protection Test



Product Protection Test



Cross Contamination Test

Microbiological Testing

Esco performs testing in accordance with more than 10 of the world's most recognized standards for local, regional and international criteria. Testing in our microbiology laboratory is conducted according to NSF / ANSI 49, EN 12469, and JIS K3800. An NSF-accredited biohazard cabinet field certifier is available in-house full-time to supervise all testing work.

Harmless *Bacillus atrophaeus* (formerly *Bacillus Subtilis*) bacteria is used to challenge the cabinet, then incubated for 48 hours and the Colony Forming Units (CFU) are counted to determine the testing results. Increased microbiological challenge tests with objects inside the cabinet work zone, Bunsen burner, external airflow disturbance, and Human-As-Mannequin test adapted from Fume Hood development were performed to simulate real-world conditions.

Personnel Protection Test

The test objective is to evaluate the safety of the cabinet for the personnel operating on potentially hazardous samples in the cabinet workzone.

- A nebulizer containing 55 mL of $5 \text{ to } 8 \times 10^8$ spores/mL *B.atrophaeus* spores is placed inside the workzone, 10 cm (4 inches) behind the front opening sash.
- Target slit air samplers and impingers are placed outside the workzone to capture possibly escaping *B.atrophaeus* spores, then the sample is incubated
- Acceptance: The number of *Bacillus atrophaeus* CFU recovered from the agar plates shall not exceed 10 CFU per test.

Product Protection Test

The test objective is to determine cabinet protection to the product/samples inside the cabinet workzone from environmental contaminants.

- A nebulizer containing 55 mL of $5 \text{ to } 8 \times 10^6$ spores/mL *B.atrophaeus* is placed at 10 cm (4 inches) in front of sash window.
- Target agar plates are placed throughout the entire work surface.
- Acceptance: The number of *Bacillus atrophaeus* CFU recovered from the agar plates shall not exceed 5 CFU per test.

Cross Contamination Test

The test objective is to evaluate cabinet protection from cross contamination of samples placed simultaneously inside the workzone.

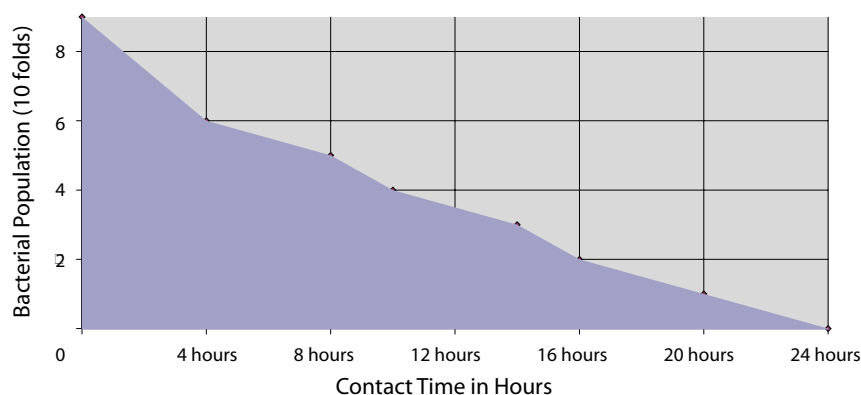
- A nebulizer containing 55 mL of spores ($5 \text{ to } 8 \times 10^4$ /mL) is placed against one of the workzone sidewalls.
- Target agar plates are placed 36 cm (14") away from the same side wall
- Acceptance: The number of *Bacillus atrophaeus* CFU recovered on agar plates shall not exceed 2 CFU per test.

HPV Test Compliant: Safer Hydrogen Peroxide Decontamination Compatibility

Esco biological safety cabinets are Hydrogen Peroxide Vapor (HPV) compliant and decontaminatable cabinets approved by BIOQUELL for this patented process. HPV is a safer and more efficient alternative to conventional decontamination using formaldehyde (CH_2O):

- HPV is non-carcinogenic and odorless, while formaldehyde is carcinogenic, toxic and has pungent smell.

ISOCIDE™ Antimicrobial Powder-Coating



All exterior painted surfaces are powder-coated with Esco Isocide, an antimicrobial inhibitor to minimize contamination. Isocide is integrated into the coating substrate and cannot wash out or diminish by repeated cleaning. Performance results are available upon request. Contact Esco or your Esco Sales Representative for details.

- If there is a gap on the cabinet sealing, escaping HPV to the lab will decompose to become oxygen and water. Escaping formaldehyde, however, is harmful to people in the lab. Therefore HPV decontamination can be performed while people still working inside the lab, while formaldehyde decontamination must be performed with no one present in the lab. The HPV method improves safety, productivity, and reduces the time to seal the cabinet.
- HPV biological efficacy is independent of environmental variables, whereas formaldehyde efficacy is dependent on such variables.
- HPV has a better penetration capacity, resulting in a full decontamination of the cabinet. The formaldehyde method is known to result in incomplete decontamination.
- HPV is more effective and rapid against biological organisms compared to formaldehyde.
- HPV requires approximately 4-7 hours for set-up, decontamination, and tear-down, compared to a total of 12-15 hours needed to complete a formaldehyde decontamination process.
- HPV decontamination effectiveness is independent of temperature and humidity. Formaldehyde requires temperature above 20°C and relative humidity above 65%.
- For information on the BIOQUELL HPV methodology contact Esco or your Sales Representative.



KI Discus Containment Test According to EN 12469 (Potassium Iodide)

Esco is currently one of the few companies in the world equipped to perform the KI Discus test for our customers. The KI Discus test is defined in the European Standard for microbiological safety cabinets, EN 12469, as a test method for validating the operator/personnel protection capabilities of the cabinet.

- The KI Discus test shows excellent correlation with the microbiological test method for operator protection, and is useful for validating the actual containment performance of the cabinet on-site.
- The KI-Discus takes only 45 minutes as opposed to 2 days for microbiological testing.
- Thus, each Esco Labculture Plus (LP2) models are factory tested on a sampling basis using the KI-Discus method for operator safety.

Purchase Specifications

LP2 Series Class II, Biological Safety Cabinet

General Performance and Certifications

1. The biological safety cabinet shall comply with the following international standards, and the manufacturer shall provide a certified copy of containment and performance tests equivalent to or greater than specified in the following independent international standards for biological safety, electrical and other functional characteristics: Class II per EN 12469.
2. The cabinet shall protect (a) the operator and laboratory environment from particulates generated within the work zone; (b) the product and process within the work zone from airborne contamination from ambient air; (c) and the product and process within the work zone from cross contamination.
4. Each cabinet shall be listed by CE for electrical safety.
5. Original documentation specific to each cabinet serial number shall be provided with the cabinet and maintained in the manufacturers' records. Test data verifying all performance criteria shall be available upon request to include: (a) inflow velocity through direct inflow measurement method; (b) downflow velocity and uniformity; (c) filter leak scan with aerosol challenge for both filters; (d) light, noise, vibration; (e) and electrical safety.

Filtration System

6. The cabinet shall have one supply downflow filter and one exhaust filter. Both filters shall be ULPA-type per IEST-RP-CC001.3 and meet EN1822 (H14) requirements.
7. The filters shall be within an aluminum frame with mini-pleat design without aluminum separators; no wood or fiberboard shall be used in the filter assembly.
8. Typical filter efficiency shall be 99.999% for 0.1 to 0.3 microns.
9. An integral filter guard shall be affixed to prevent damage to the filter media.
10. The filters shall be (a) individually scan tested by the manufacturer, (b) individually scan tested after assembly, and (b) easily accessible for scan testing in situ by means of a dedicated upstream sampling port accessible from within the cabinet.

Comprehensive Performance Testing At Esco



Every Labculture Plus LP2 model manufactured by Esco is individually tested, documented by serial number and validated with the following test methods.

- Inflow / downflow velocity
- PAO aerosol challenge for filter integrity
- Light, noise and vibration
- Airflow pattern visualization
- Electrical safety to IEC61010-1
- Additional KI-Discus and microbiological testing is performed on statistical sampling basis.

11. The supply filter shall be angled and oriented to the 5° cabinet front angle to maximize downflow uniformity over the work surface.
12. A removable, perforated metal diffuser shall be installed below the supply filter to optimize airflow uniformity and to protect from damage.

Blower System

13. The cabinet shall have a direct drive, permanently lubricated centrifugal blower/motor dynamically balanced in two planes compliant to ISO2710 for low noise, low vibration and long filter life.
14. The blower/motor shall have an external rotor design and include an automatic thermal cut-out to disable the motor in case of overheating.
15. The blower/motor shall have an automatic speed control to compensate for filter loading.
16. The blower/motor system shall be enclosed within a dynamic chamber shaped steel plenum and integrated with the removable supply filter assembly to simplify filter changing.

Cabinet Design, Construction, Cleaning

18. The cabinet shall be of double wall design whereby all positive pressure plenums capable of handling contaminated air shall be surrounded by negative pressure. No positive pressure areas shall be accessible external to the cabinet.
19. The cabinet shall maintain containment performance even when removable work area components are removed for cleaning.
20. Single-piece or multi-piece tray, removable, stainless steel with radius corners without crevices or joints.
21. The cabinet shall have a stainless steel, one-piece fabricated drain trough with open angles to channel spills to a common drain.
22. The closed sidewall shall be sealed without perforations, return air slots or concealed areas which can contain contaminants.
23. The cabinet shall be free of sharp edges, non-functional protrusions, bolts, screws or hardware, and all metal edges shall be deburred.



Multi-piece tray, removable, stainless steel with radius corners

Ergonomics and Convenience

25. The front sash shall be frameless to maximize visibility, and accessible for cleaning front and back. Sash glass shall be safety glass.
26. Motorized front sash allows finger-tip operation.
27. Magnetic, not mechanical, proximity sensors shall work in conjunction with the control system to indicate proper sash position for containment.
28. Fluorescent lamps shall be mounted behind the control panel module out of the work zone. Electronic ballasts shall be used to eliminate flicker, extend lamp life and reduce heat output.
29. The UV lamp shall operate via an automatic timer with automatic shut-off managed by the microprocessor controller and shall be interlocked with the blower/motor and fluorescent lights for safety.
30. The cabinet shall be designed with a 5° angled front to optimize user comfort, reduce glare and maximize reach into the work area.
31. Penetrations for petcocks and service fittings shall be provided; penetrations shall be offset to improve user access.
32. The cabinet shall accommodate an optional mounting stand for fixed-height or adjustable-height configurations.

Control and Alarm System

33. All cabinet functions shall be managed by a programmable microprocessor control system capable of software updates via Internet downloads.
34. The microprocessor controller shall be mounted on the main control panel facing down toward the user.
35. The controller shall include soft-touch keypad controls and backlit LCD displays to permit operation of the blower/motor, light, UV lamp, electrical outlet(s) and menu.
36. The controller shall be user programmable in situ to enable or disable functions such as PIN (personal identification number) access restriction, cabinet start-up protocol, airflow alarm and other microprocessor controlled operations outlined in the user manual.
37. When programmed ON, the start-up protocol shall perform an automatic pre-purge and post-purge cycle to ensure proper cabinet operation.
38. The controller shall include a blower/motor hours meter to display aggregate motor running time to assist in predictive maintenance.
39. Audible and visual alarms shall be provided for unsafe conditions such as improper airflow or sash position.
40. Airflow shall be monitored by two temperature compensating, thermistor-based, true air velocity sensor mounted in the cabinet.
41. The airflow display and alarm system shall be individually calibrated before shipment.
42. The main control panel shall exhibit continuous display of air velocity and a 24-hour clock display.

Certification, Service and Decontamination

43. The cabinet shall be approved for both hydrogen peroxide vapor (HPV) and formaldehyde decontamination protocol.
44. All panels leading to potentially contaminated and/or hazardous areas shall be color coded red.
45. All components with the exception of blower/motor and ULPA filters shall be located outside of contaminated air spaces to facilitate servicing without the need to decontaminate the cabinet.
46. All exterior surfaces shall be painted with a permanent antimicrobial inhibitor coating to minimize contamination.
47. Each cabinet shall undergo the following tests in the factory.
 - Inflow/ downflow velocity
 - Filter leaks test
 - Light, noise, and vibration
 - Electrical safety to IEC 61010-1



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