

**Wide Range of Construction Configurations to Suit User Requirements**

**Performance:** Mini-pleated HEPA Filtration for 99.99% Typical Efficiency  
or Mini-pleated ULPA Filtration for 99.999% Typical Efficiency

**Low Noise Levels:** <56dBA<sup>1</sup>

**Low Energy Consumption:** 80W<sup>1\*\*</sup>, Energy-Efficient Blower Technology

<sup>1</sup>For a standard 2'x4' or 600x1200mm unit with AC blower running at 0.45 m/s or 90fpm measured at 1m from filter face

<sup>\*\*</sup>For *optional* EC blower systems. FFU with AC blower system typical power consumption: 220W

### ESCO AIRSTREAM® FAN FILTER UNITS

Esco's Airstream® Cleanroom Fan Filter Unit is a leading-edge fan filter unit (FFU) designed to provide filtered laminar airflow over a specific area. The unit integrates a high efficiency fan together with a HEPA / ULPA filter. The FFU draws in contaminated air from the top of the module, and exhausts filtered clean air vertically in a unidirectional (laminar) air stream at its base. FFU's are commonly used in the construction of Class 1 to Class 100,000 cleanrooms (as per the US Federal Standard 209E).

**We have leveraged our experience of more than 20 years in cleanroom design and construction (a business we are no longer engaged in) to develop an FFU that simply performs better at a lower cost.** Our in-house research and development facilities include an acoustically-insulated HEPA-filtered test environment chamber, where Airstream® Fan Filter Unit design is optimized for low noise level and energy efficiency.

**Our manufacturing capabilities range from complete computerised sheet metal design, to fabrication and assembly. A vertically-integrated approach** ensures that quality can be controlled at every step of the way. To ensure performance and quality, only materials from leading suppliers are used. Furthermore, all incoming raw materials are inspected via a statistical sampling method.

#### Quality control at factory before shipment:

- ◆ Functional tests and visual inspection
- ◆ Electrical safety analysis tests
- ◆ Air velocity testing

Unlike other manufacturers, Esco is one of the few manufacturers of fan filter units with core expertise in the design of other high performance clean air and containment equipment through our other business divisions.

### GENERAL FEATURES

**Lightweight, corrosion-resistant construction** is completely smooth and cleanroom-compatible.

**Permanently lubricated, direct-drive centrifugal blower.**

**Industry exclusive blower technology** operates at higher energy efficiency levels with larger airflow volumes.

**Proprietary construction technology** creates better airflow uniformity across the entire filter face for superior laminar flow and product protection.

**Choose from conventional AC or energy efficient EC blowers** depending on the requirements of your specific clean air application.

**Standard blower speed controller** allows for easy adjusting of the FFU speed controller.

**Improved mounting techniques and sound insulation materials** reduce blower noise for increased operator comfort and productivity.

**Quiet operation of less than 56dBA** (measured at a



*Above: R&D testing at Esco's research laboratory with airflow and noise level test instrumentation*

**Common applications** for these units include:

- ◆ Conventional cleanroom construction
- ◆ Modular hard and soft wall cleanrooms
- ◆ Laminar flow cabinets and other clean air devices

The Airstream® Fan Filter Unit provides high airflow volumes at greater efficiency levels and delivers high performance levels whether used in the construction of cleanrooms or clean air devices. It is available in **a wide range of construction sizes and options** and operates at **low noise / power consumption levels**.

distance of 1m from the unit at the standard airflow velocity of 0.45 m/s or 90 fpm with standard AC blower). For detailed information on FFU noise levels, refer to page 6.

**Integral HEPA / ULPA filter:** different filter types available on request.

**Integral metal faceguard protects the HEPA / ULPA filter** from damage during installation and transportation.

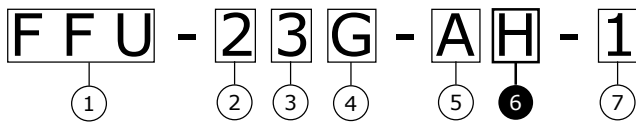
**Fan inlet guard grille** ensures operator safety during installation and prevents large objects from falling into the casing and damaging the blower.

**Choose from a variety of exterior construction materials and styles** depending on the requirements of your specific clean air application.

**Unique modular one-piece blower and electrical assembly** is designed to be serviceable and easily replaceable at lower maintenance costs.

Standard unit shipped with 3 core electrical wires. Power cord is optional. Specify when ordering.

**All electrical components UL-approved** (only 115VAC 60HZ models).



For explanation of the ordering code refer to page 7 of this catalogue

## FILTER FEATURES

### [H] Minipleat separatorless HEPA filter

### [U] Minipleat separatorless ULPA filter

- ♦ All filters factory scan-tested and serialized
- ♦ All filters are compliant to the requirements of performance standards: IEST-RP-CC034.1, IEST-RP-CC007.1, IEST-RP-CC001.3 and EN1822
- ♦ Different filter heights available: 50mm (low cost), 66mm (standard), 90mm (extra long life and reduced noise)

## FILTRATION AGENTS

Esco Airstream® fan filter units are available with **latest mini-pleat separatorless HEPA or ULPA filters** by **Camfil Farr®**, headquartered in Sweden, a leading global manufacturer of filters and clean-air solutions.

HEPA and ULPA filters are **constructed of pleated borosilicate glass fibers which are glued into an aluminium frame.**

**The aluminium frame is gasketed** to form the final filter assembly with a **single-piece gasket** that reduces the possibility of leakage / gasket damage.

The numerous advantages of the mini-pleat separatorless filter technology over the conventional aluminium separator filter technology include:

- ♦ Compact size that contains more pleat per unit of filter surface area.
- ♦ Increased media area with more effective dust holding and longer filter life.
- ♦ Aluminium frame that is lighter than the conventional wooden frame used in aluminium separated filter technologies. The aluminium frame also eliminates the possibility of swelling in moist conditions present with conventional wooden-frames.
- ♦ Eliminates the possibility of filter damage by aluminium separators.

## [U] SUPERIOR-EFFICIENCY ULPA FILTERS

**ULPA filters** (Ultra Low Penetration Air) are a superior filter type to the conventional HEPA (High Efficiency Particulate Air) filters used by most other manufacturers. While HEPA filters provide 99.99% typical efficiency at 0.3 micron level, ULPA filters provide 99.9998% typical efficiency at 0.3 & 0.12 micron levels and 99.9997% at MPPS (Most Penetrating Particle Size).

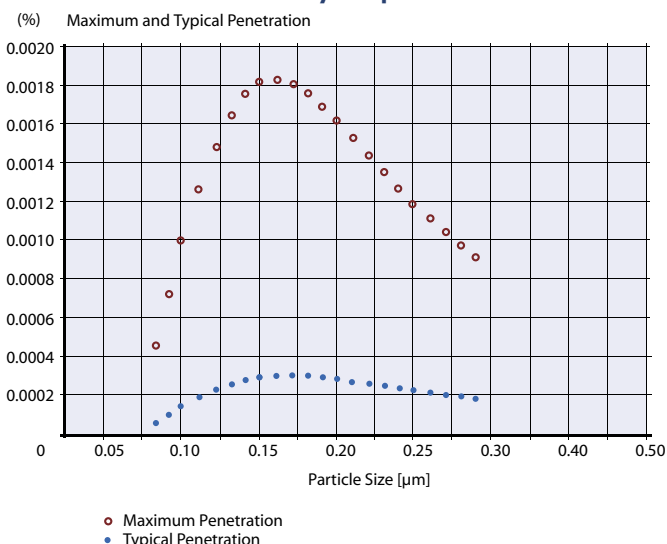
**ULPA filters deliver localised clean air exceeding ISO Class 4 air cleanliness requirements (Class 10 as per the US Federal Standard 209E).** Recommended for use in the construction of cleanrooms meeting Class 1 to Class 10 requirements or for Class 10 clean air devices.

## [H] HIGH-EFFICIENCY HEPA FILTERS

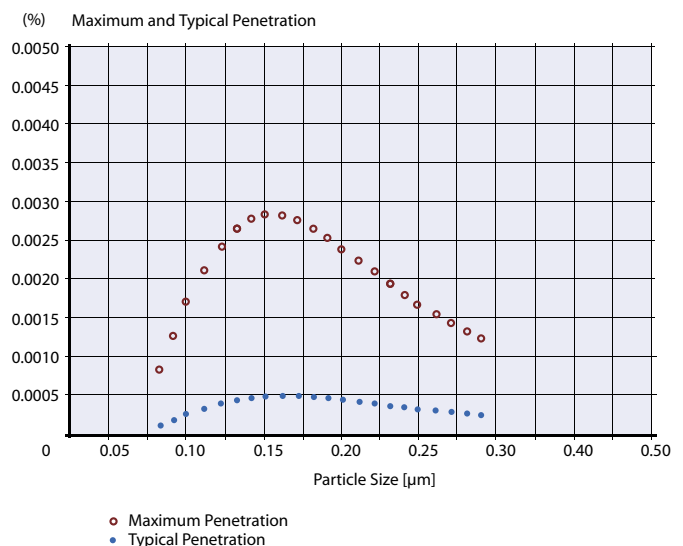
**HEPA filters** (High Efficiency Particulate Air). While HEPA filters offered by competitors provide 99.99% typical efficiency at 0.3 micron level, HEPA filters on Esco fan filter units can provide 99.99976% typical efficiency at 0.3 microns, 99.9996% at 0.12 micron levels and 99.99951% at MPPS (Most Penetrating Particle Size).

**HEPA filters deliver localised clean air exceeding ISO Class 5 air cleanliness requirements (Class 100 as per the US Federal Standard 209E).** Recommended for use in the construction of cleanrooms meeting Class 100 to Class 100,000 requirements or for Class 100 clean air devices.

**ULPA Filter Efficiency Graph\***



**HEPA Filter Efficiency Graph\***



**\*NOTE:** Above filter efficiency graphs reflect filter efficiencies for HEPA & ULPA filters with 66mm / 2.6" height for the nominal airflow velocity of 0.45 m/s or 90fpm. Filter efficiency figures change with different airflow settings and filter heights, e.g. filter efficiency will be higher for lower airflow velocities and vice versa.

### CONSTRUCTION OPTIONS

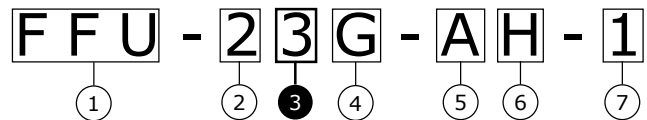
#### [2] Version 2 type (integral blower + filter casing)

Unit can be suspended from the ceiling; better appearance since entire unit is in one-piece.

**[3] Version 3 type** (separate blower + housing module, and filter) Lower cost, however unit cannot be ceiling suspended, and appearance is also poorer: suitable when the unit is mounted in the cleanroom ceiling.

Refer to pg.6 of this catalogue for engineering diagrams of Version 2 and Version 3 Fan Filter Unit types.

#### 3. RSR type (room-side replaceable)



### EXTERIOR CONSTRUCTION MATERIALS

Choose from the following exterior construction materials to suit your requirements.

#### [G] Galvanized Steel

Galvanized steel construction provides a more economical alternative when external appearance is not the most important factor. Esco only uses the highest grade steel coated in order to prevent rust and corrosion. This material may be recommended when cost is of the highest priority and when the fan filter unit is used in applications such as the construction of cleanrooms (in which the main body itself is isolated and "hidden" from view in the cleanroom ceiling).

#### [A] Aluminium

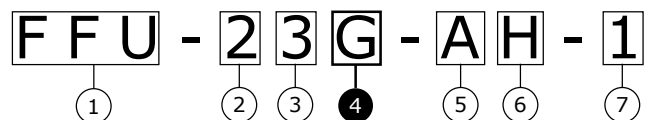
Aluminium construction is the most common material of choice and provides a cost-effective solution for all fan filter unit applications. Aluminium is light-weight, corrosion-resistant, will not generate particles, and is thus cleanroom-compatible. Esco uses only the highest quality anodized aluminium for an industrial-grade finish that is both aesthetic and durable.

#### [P] Powder-Coated Steel

Construction in coated steel with an abrasion-resistant powder-coated finish. This exterior finish provides a visually attractive, durable, smooth and totally cleanroom compatible finish. Recommended when the fan filter unit is exposed to exterior view such as in the construction of modular clean air devices and laminar flow cabinets, and when custom colours are required. Cost is approximately the same as aluminium construction.

#### [S] Stainless Steel

Construction in stainless steel. This exterior finish provides a visually attractive, durable and smooth finish. Recommended when required for pharmaceutical applications, and is the highest in terms of the cost.



### BLOWERS USED ON AIRSTREAM® FAN FILTER UNITS

Esco Airstream® Fan Filter Units utilize permanently lubricated centrifugal external-rotor motor blowers from **ebm-papst**, manufacturer of innovative fan and motor technology headquartered in Germany.

External rotor-motor designs are known for their compact and flat build and energy-efficiency. Due to the fact that the external-rotor motor is integrated in the impeller, the design allows for optimum cooling of the motor (see illustration below).

All rotating parts are directly fitted to one component and dynamically balanced as such. Total weight is equally distributed to both bearings.

Esco Airstream® Fan Filter Units are available with **standard AC centrifugal blowers from ebm-papst**, as well as with **energy-efficient electronically commutated (EC) backward-curve centrifugal blower systems**.

## ebmpapst

**The main advantages of the ebm-papst external-rotor motor design include:**

Compact and low-noise construction (fan blades are attached directly to the outside of the rotor)

Superior dynamically balanced design

Perfect bearing alignment

100% speed control

Optimum heat transfer out of motor leading to less stress to the insulation system

Longer bearing service life

## BLOWER OPTIONS



### [A] Standard AC blower

Airstream® Fan Filter Units utilize a standard AC blower, the advantages of which include:

- ♦ Low noise level
- ♦ Low power consumption

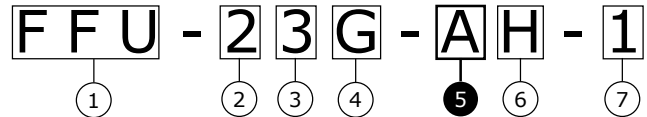


### [B] EC blower

(optional remote monitoring + control system)

Optional EC blower is available and has the following advantages:

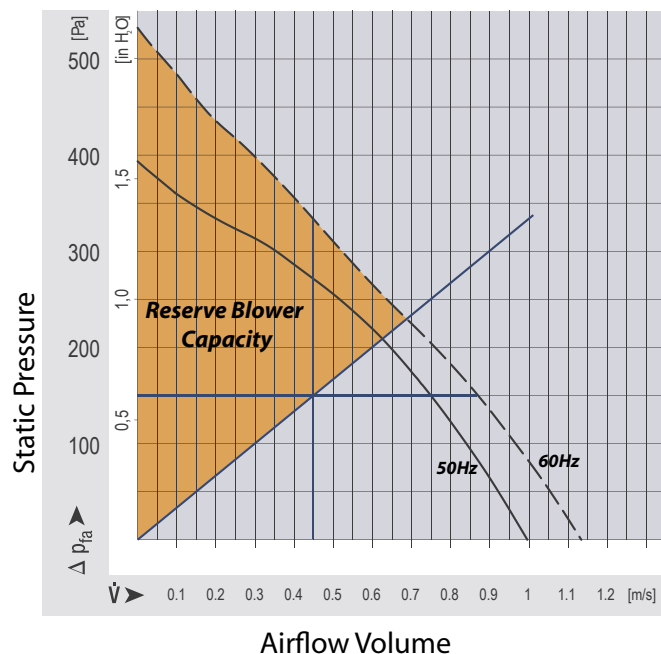
- ♦ Low noise level
- ♦ Low power consumption
- ♦ Low heat output
- ♦ **With EC blowers, 100's of FFU's may be connected via a network to a single computer system for centralised maintenance and remote monitoring.**



Above: An example of a FFU with EC centrifugal blower connected to a laptop computer for remote monitoring and maintenance.

## SPECIFICATIONS FOR AIRSTREAM® FAN FILTER UNIT, STANDARD FFU SIZE: 2' X 4' / 1200MM X 600MM

### STANDARD AC BLOWER



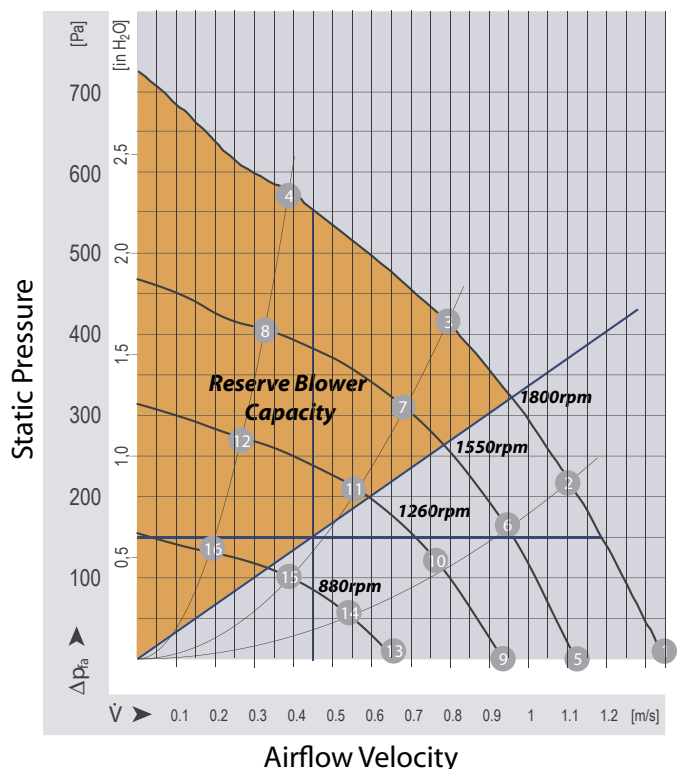
### BLOWER SPECIFICATIONS (EXAMPLE) 2'x4'x2.6" (600x1200x66MM) MODELS

BLOWER TYPE	Typical Power Consumption*	Noise Level**
Standard AC blower	220W	<56dBA
Optional EC blower	80W	<54dBA

\*Applicable for 2'x4' FFU models at the standard airflow velocity of 0.45m/s or 90fpm.

\*\*Measured at a distance of 1m from the 2'x4' FFU unit at the standard airflow velocity of 0.45 m/s or 90fpm.

### EC BLOWER



Reserve Blower Capacity is the area between the filter pressure-to-airflow line and the fan curve. Above data reflects Reserve Blower Capacity for a standard Airstream® Fan Filter Unit equipped with a pre-filter and a HEPA filter, FFU size: 2' x 4' / 1200mm x 600mm (standard height of 2.6" or 66mm), with the nominal setting of 0.45 m/s and 150 Pa filter pressure drop.

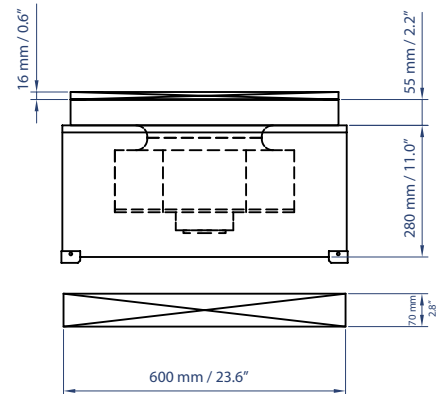
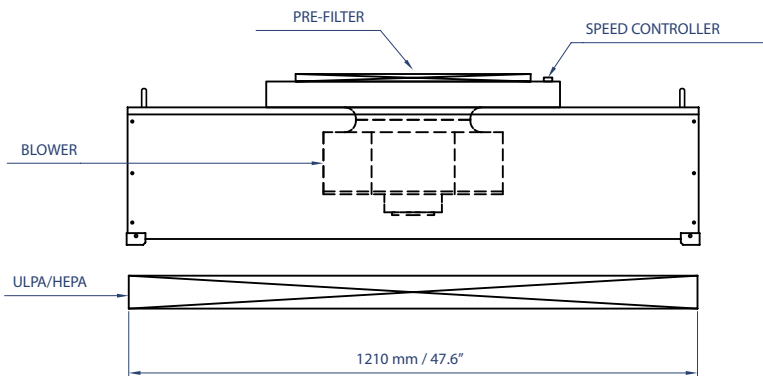
For fan curves for other FFU sizes, please contact Esco.

### VERSION 3 FAN FILTER UNIT EXAMPLE

Separate blower / housing module and HEPA/ULPA Filter  
Size: 2'x4'

FFU - 2 2 G - A H - 1

① ② ③ ④ ⑤ ⑥ ⑦

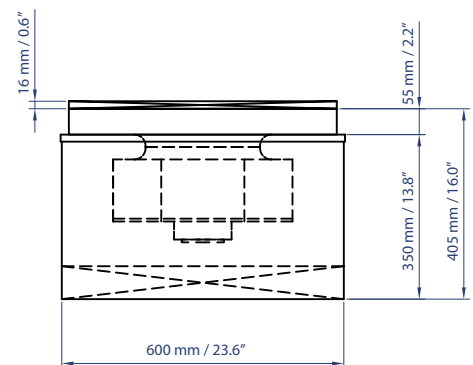
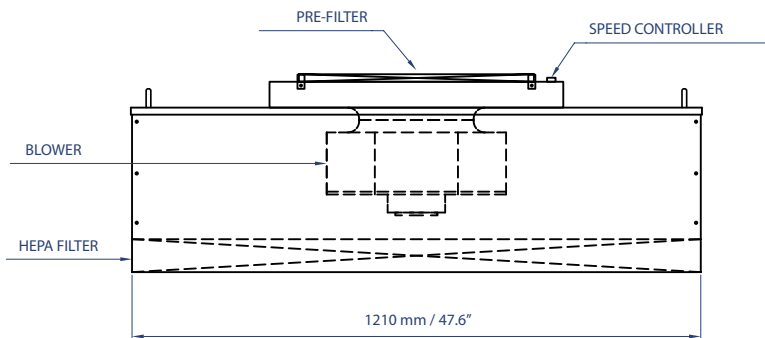


### VERSION 2 FAN FILTER UNIT EXAMPLE

Integral blower + filter casing  
Size: 2'x4'

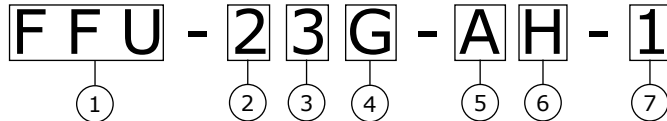
FFU - 2 3 G - A H - 1

① ② ③ ④ ⑤ ⑥ ⑦



GENERAL TECHNICAL SPECIFICATIONS			
		2'x2' models	2'x4' models
Air Volume at Initial Airflow Velocity Setting		602 cmh / 355 cfm	1150 cmh / 680 cfm
Cleanliness of Localized Air		Class 100 or equivalent as per Federal standard 209E BS5295,VDI2083 and AS 1386	
Standard Body Construction		Galvanized steel construction body / Corrosion-resistant / Cleanroom-compatible <i>For a full list of construction materials, refer to page 7.</i>	
Filtration Elements		Main Filter: Choose from either a HEPA filter or an ULPA filter Pre-Filter: Washable non-woven polyester fibers with an efficiency of 20%	
Pre-Filter Efficiency		Arrestance 85%, efficiency 20%	
Main Filtration Efficiency	HEPA	Typical efficiency: 99.99976% at 0.3µm, 99.9996% at 0.12µm and 99.99951% at MPPS	
	ULPA	Typical efficiency: 99.9998% at 0.3 & 0.12µm and 99.9997% at MPPS	
Noise Level		<56 dBA (at initial AC blower speed setting; subject to ambient conditions) <54 dBA (at initial EC blower setting; subject to ambient conditions) <50 dBA (with optional extra high efficiency noise baffling)	
Power Supply Options		Choose from the following power supply configurations, and indicate code at the end of the model's ordering code (e.g.: FFU-32G-AH-2 for 110-130VAC 50HZ/60HZ configuration) 1: 220-240VAC 50HZ/60HZ 2: 110-130VAC 50HZ/60HZ 3: 100-110VAC 50HZ/60HZ	

## ORDERING CODES



### 1. Fan Filter Unit

### 2. Standard Sizes

- 2=2'x2' / 600x600 mm
- 3=2'x4' / 600x1210 mm
- 4=4'x4' / 1210x1210 mm
- 5=1200x1200 mm (metric version)
- 6=1200x600 mm (metric version)

### 3. Version Options

- 2=Version 2
- 3=Version 3

### 4. Construction Material Options

- G=Galvanized steel
- A=Aluminium

P=Powder-coated electro-galvanized steel

S=Stainless steel

### 5. Blower Options

- A=AC fan
- B=EC fan

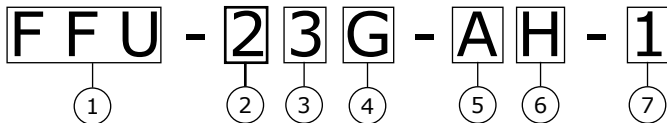
### 6. Filter Options

- H=HEPA Filter
- U=ULPA Filter

### 7. Electrical Supply Options

- 1=220-240VAC 50HZ/60HZ
- 2=110-130VAC 50HZ/60HZ
- 3=100-110VAC 50HZ/60HZ

## ORDERING CODE: EXAMPLES



Esco Airstream® FFU's are available in a variety of configurations to suit the user's requirements. Below are some examples of the different configurations in which these models can be ordered.

### FFU-33G-BH-2:

**[3]** 2'x4' (600x1210mm) **[3]** Version 3 FFU constructed of **[G]** galvanized steel. **[B]** Energy efficient EC blower. **[H]** High efficiency HEPA filter. **[2]** Electrical supply configuration: 110-130VAC 50HZ/60HZ

### FFU-52S-AU-3:

**[5]** 1200x1200mm **[2]** Version 2 FFU constructed of **[S]** stainless steel. **[A]** Standard AC blower. **[U]** Superior efficiency ULPA filter. **[3]** Electrical supply configuration: 100-110VAC 50HZ/60HZ

### FFU-43A-BU-1:

**[4]** 4'x4' (1210x1210mm) **[3]** Version 3 FFU constructed of **[A]** aluminium. **[B]** Energy efficient EC blower. **[U]** Superior efficiency ULPA filter. **[1]** Electrical supply configuration: 220-240VAC 50HZ/60HZ

## OPTIONAL FEATURES

- ♦ *Optional* walkable plenum (uses thicker gauge metal sheet for the body, so it can support the weight of a person)
- ♦ *Optional* eye bolts for hanging the unit from a ceiling
- ♦ *Optional* collar for connection to A/C system
- ♦ *Optional* economy blower
- ♦ *Optional* extra high efficiency noise baffling (reduces noise levels to less than 50dBA)
- ♦ *Optional* remotely adjustable speed controller
- ♦ *Optional* motor voltage measurement port

## OPTIONAL FILTER FEATURES

- ♦ *Optional* laminator available for +/-5% airflow uniformity
- ♦ *Optional* downstream or both side faceguard for protection against damage
- ♦ *Optional* removal of pre-filter
- ♦ *Optional* downstream gasketing



**OTHER PRODUCTS AVAILABLE FROM ESCO CLEANROOM CONSTRUCTION COMPONENTS DIVISION:**

**Air Shower Pass Throughs**



**Air Shower Pass Boxes**



**Cleanroom Air Shower**



One of Esco's five main divisions, our **Cleanroom Construction Components** division specializes in HEPA-filtered cleanroom construction components for use in critical environments to protect products and processes from micro-contamination.

Our product line is employed internationally by many of the world's most reputable cleanroom engineering firms in turnkey cleanroom construction projects.

We invite you to learn more about how Esco can help you reduce capital and long-term costs, increase efficiency, and achieve only the most stringent levels of contamination control performance.

- Backed by Esco's unparalleled experience of more than 20 years in critical environments and cleanrooms; not only in clean air device manufacturing but also turnkey projects.
- Lowest initial capital investment and life cycle costs; coupled with technical innovation recognized the world over.
- Compliance with the latest international standards for clean air, critical environments and electrical safety.
- Fully integrated and mechanized manufacturing processes at our sheet metal processing centre utilizing only raw materials of the highest quality and the latest industrial production techniques.
- Competitive lead times with many items from stock.



***All products are manufactured under  
a quality system registered to:***  
**ISO 9001 TOTAL QUALITY MANAGEMENT**  
**ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM**

