How Many FFUs Needed for a Modular Cleanroom?

Product Designer: Jason.peng | Deiiang™

I. Introduction

A. Core Question Answer

The number of FFUs (Fan Filter Units) required for a **modular cleanroom** is not a fixed value but depends on multiple critical factors working together. The most important factors include the target cleanliness level (ISO class), room volume, **FFU** performance specifications, and the specific application requirements.

Calculating the correct number of **FFU** units is essential for creating an effective **modular cleanroom** environment. A properly designed **modular cleanroom** with the right **FFU** configuration ensures optimal performance and efficiency.

B. Importance of FFUs & Correct Calculation

FFUs play a crucial role in cleanroom operations by providing filtered air and controlling airflow patterns. They are essential components in any **modular cleanroom** setup, ensuring consistent air quality throughout the space.

Incorrect **FFU** calculations can lead to serious consequences including failure to meet cleanliness standards, energy waste from over-specification, increased operational costs, and compromised product quality. For any **modular cleanroom** project, proper **FFU** planning is critical.

II. Understanding FFU & Modular Cleanroom Basics

A. What is an FFU?

An FFU (Fan Filter Unit) is a self-contained air purification device that combines a fan motor and high-efficiency filter (HEPA or ULPA) in a single housing. These units are fundamental components in modern **modular cleanroom** designs, providing the necessary air filtration and circulation.

Each **FFU** typically includes a centrifugal fan, HEPA/ULPA filter, and control system, working together to draw in ambient air, filter out contaminants, and deliver clean air downward in a uniform pattern. The efficiency of these **FFU** units directly impacts the overall performance of the **modular cleanroom**.

B. What is a Modular Cleanroom?

A **modular cleanroom** is a prefabricated controlled environment constructed from standardized panels and components. Unlike traditional built-in-place cleanrooms, these systems offer significant advantages including flexibility, rapid installation, scalability, and cost-effectiveness.

Feature	Modular Cleanroom
Installation Time	Weeks
Flexibility	High (easily reconfigured)
Cost	Lower initial investment
FFU Integration	Pre-designed for optimal FFU placement

III. Key Factors Affecting FFU Quantity

A. Cleanliness Class - ISO 14644-1 Standards

The ISO cleanliness classification is the primary determinant for **FFU** requirements in a **modular cleanroom**. Higher cleanliness classes require more air changes per hour (ACH), directly impacting the number of **FFU** units needed.

ISO Class	Maximum Particles/m³ (≥0.5 μm)
ISO 5 (Class 100)	3,520
ISO 6 (Class 1000)	35,200
ISO 7 (Class 10,000)	352,000
ISO 8 (Class 100,000)	3,520,000

B. Cleanroom Dimensions

The physical size of your **modular cleanroom** directly impacts **FFU** requirements. A room measuring 10m × 8m × 3m has a volume of 240m³, while a larger 15m × 10m × 3m room has 450m³ volume - nearly double the air volume to filter.

C. Application & Internal Activities

Different industries have varying contamination control needs. Electronics manufacturing might require ISO 6 with specific humidity control, while pharmaceutical applications often need ISO 5 with strict temperature and monitoring. Each application affects the **FFU** configuration in your **modular cleanroom**.

D. FFU Performance Parameters

Individual **FFU** specifications vary significantly. A standard 2x4 ft **FFU** might deliver 900-1200 CFM, while high-performance models can reach 1500+ CFM. Deiiang™ offers various **FFU** models with different specifications to match your **modular cleanroom** requirements.

E. Airflow Pattern

Unidirectional Flow: In ISO 5 environments, FFUs typically cover 80-100% of the ceiling area, creating uniform downward airflow. This requires more FFUs but provides superior contamination control.

Non-unidirectional Flow: For ISO 6-8 applications, FFUs are arranged in arrays covering 15-40% of the ceiling, relying on air dilution rather than piston-like flow.

F. Room Pressure Requirements

Maintaining positive pressure (typically +10 to +25 Pa) prevents unfiltered air from entering the **modular cleanroom**. This pressure differential requires additional airflow, potentially increasing **FFU** requirements by 5-15% depending on room sealing and air leakage rates.

IV. FFU Quantity Calculation Method & Examples

A. Basic Calculation Formula

Step 1: Calculate Room Volume
Volume (m^3) = Length (m) × Width (m) × Height (m)

Step 2: Calculate Total Required Airflow
Total Airflow (m^3/h) = Room Volume (m^3) × Target ACH

Step 3: Calculate Number of FFUs
Number of FFUs = Total Airflow (m^3/h) ÷ Single FFU Airflow (m^3/h)

Note: Always include a safety factor of 10-20% for leakage and future requirements.

B. Step-by-Step Calculation Examples

Example 1: ISO 7 Modular Cleanroom

Parameters:

- Room dimensions: 8m (L) × 6m (W) × 2.8m (H)
- ISO Class: 7 (Target ACH: 50)
- FFU type: Deiiang™ 2x4 ft FFU (1200 m^3/h capacity)
- Safety factor: 15%

Calculation:

1. Volume = 8 × 6 × 2.8 = 134.4 m^3
2. Total Airflow = 134.4 × 50 = 6,720 m^3/h
3. With safety factor: 6,720 × 1.15 = 7,728 m^3/h
4. Number of FFUs = 7,728 ÷ 1,200 = 6.44 → **7 FFUs**

Example 2: ISO 5 Modular Cleanroom

Parameters:

- Room dimensions: 5m (L) × 4m (W) × 2.6m (H)
- ISO Class: 5 (Target ACH: 300)
- FFU type: Deiiang™ 2x2 ft FFU (600 m^3/h capacity)
- Safety factor: 10%

Calculation:

1. Volume = 5 × 4 × 2.6 = 52 m³
2. Total Airflow = 52 × 300 = 15,600 m³/h
3. With safety factor: 15,600 × 1.10 = 17,160 m³/h
4. Number of FFUs = 17,160 ÷ 600 = 28.6 → **29 FFUs**

Parameter	Example 1 (ISO 7)
Room Volume	134.4 m³
Target ACH	50
FFU Type	2x4 ft (1200 m³/h)
FFUs Required	7
Ceiling Coverage	~20%

C. Online FFU Quantity Calculator

Try Our Interactive FFU Calculator

Calculate Your FFU Requirements

Get instant calculations based on your specific modular cleanroom parameters

V. FFU Layout & Installation Considerations

A. Airflow Uniformity & Dead Zones

Proper FFU placement is crucial to avoid dead zones where contaminants can accumulate. In a typical **modular cleanroom**, FFUs should be evenly distributed across the ceiling with special attention to corners and equipment areas.

For ISO 5 applications, FFUs are typically arranged in a grid pattern covering most of the ceiling. For lower classes, strategic placement around critical processes may be sufficient.

Deiiang™ engineers use computational fluid dynamics (CFD) analysis to optimize **FFU** placement in your **modular cleanroom**, ensuring uniform airflow distribution.

B. Maintenance & Replacement

FFU placement should allow easy access for filter replacement and maintenance. Most HEPA filters in **FFU** units need replacement every 3-5 years, depending on operating hours and environmental conditions.

C. Noise & Energy Consumption

Modern **FFU** designs from Deiiang™ feature energy-efficient EC motors that reduce power consumption by 30-50% compared to traditional AC motors. Noise levels typically range from 45-65 dB, important for operator comfort in the **modular cleanroom**.

VI. Frequently Asked Questions

Q1: What are the common FFU sizes?

The most common FFU sizes are 2x2 ft (600x600mm), 2x4 ft (600x1200mm), and 4x4 ft (1200x1200mm). Deiiang™ offers all standard sizes plus custom dimensions for specialized **modular cleanroom** applications.

Q2: HEPA vs. ULPA filters – which should I choose?

HEPA filters are 99.97% efficient at 0.3μm, suitable for ISO 5-8. ULPA filters are 99.999% efficient at 0.12μm, used for ISO 3-5 applications. Most **modular cleanroom** installations use HEPA filters in their **FFU** units.

Q3: How often do FFU filters need replacement?

Typically every 3-5 years, but this depends on operating hours, particle load, and pressure drop monitoring. Regular maintenance of your **FFU** system extends filter life in the **modular cleanroom**.

Q4: Can I upgrade my FFU system later?

Yes, one advantage of a **modular cleanroom** is the ability to upgrade or reconfigure **FFU** systems as requirements change. Deiiang™ designs allow for future expansion and technology upgrades.

Q5: How do I know if my FFU count is sufficient?

Regular particle counting and airflow velocity measurements will verify performance. Deiiang™ provides certification services to ensure your **modular cleanroom** with the installed **FFU** system meets specified standards.

VII. Conclusion & Professional Recommendation

A. Summary of Key Points

Determining the correct number of FFUs for your **modular cleanroom** requires careful consideration of multiple factors including ISO classification, room dimensions, application requirements, and **FFU** specifications. The examples and calculations provided serve as guidelines, but professional assessment is recommended for optimal results.

B. Call to Action

Need Professional Assistance with Your Modular Cleanroom Project?

Contact Deiiang™ experts for a customized cleanroom design, FFU selection consultation, or free quotation.

Request Consultation

View FFU Products

A Deiiang™ modular cleanroom installation with optimized FFU placement