

OPES ORION CLEANROOM SYSTEMS

ADVANCED ISO 5 & ISO 7
AIRFLOW ENGINEERING FOR
MODERN OPERATING THEATRES

OPES ORION ENGINEERING TEAM



OPES
— ORION —

THE ULTIMATE GOAL IS INFECTION CONTROL

Operating theatres require highly controlled environments to mitigate

SURGICAL SITE INFECTIONS (SSI)

Airborne contamination—comprising bacteria, particles, and pathogens—poses a direct threat during invasive procedures.

Standard commercial HVAC systems lack the velocity, directional control, and filtration necessary for critical medical procedures.



Operating Theatres are Not Semiconductor Cleanrooms

Industrial Cleanrooms

Primary Goal: Protect the Product (microelectronics, semiconductors).

Airflow Design: Full-room laminar flow.

ISO Class Strategy: The entire room maintains a single, uniform ISO classification.

Healthcare Cleanrooms

Primary Goal: Protect the Patient (infection control).

Airflow Design: Localized laminar airflow canopy.

ISO Class Strategy: Targeted ISO zones to optimize safety and energy efficiency.

Targeted Cleanliness Maximizes Safety and Efficiency

Instead of conditioning an entire room to extreme standards, modern operating theatres utilize a layered, dual-zone approach. This ensures absolute sterility where it matters most while maintaining excellent general room conditions.

ISO 5 Sterile Surgical Field

Maximum
3,520
particles ($\geq 0.5 \mu\text{m}$)
per cubic meter.

Positioned directly over the patient and surgical instruments.



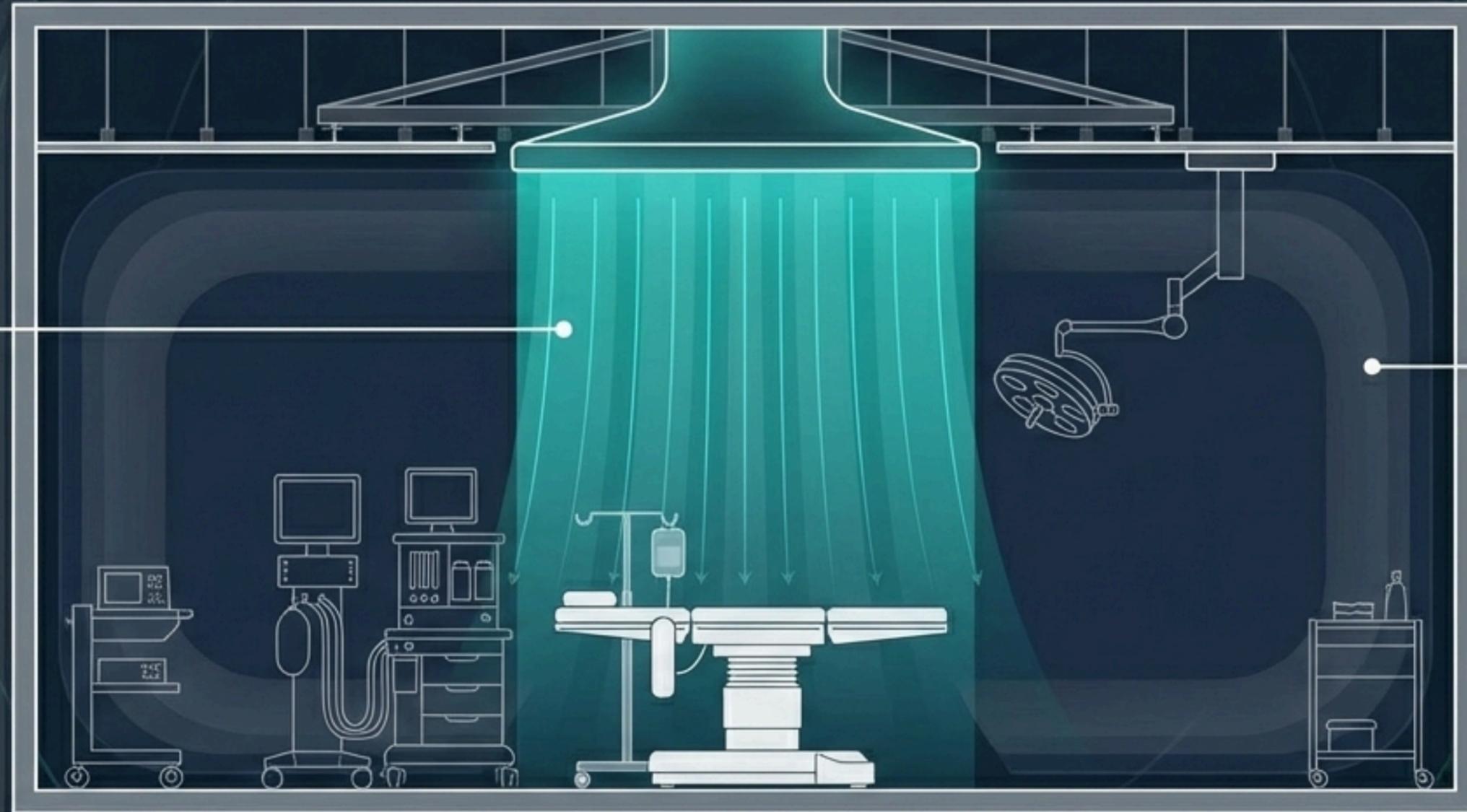
ISO 7 General Operating Room

Maximum
352,000
particles ($\geq 0.5 \mu\text{m}$)
per cubic meter.

Maintained throughout the peripheral room space for staff and supporting equipment.

Mapping the Dual-Zone Operating Theatre

**ISO 5 Laminar
Airflow Canopy**
Sora Regular

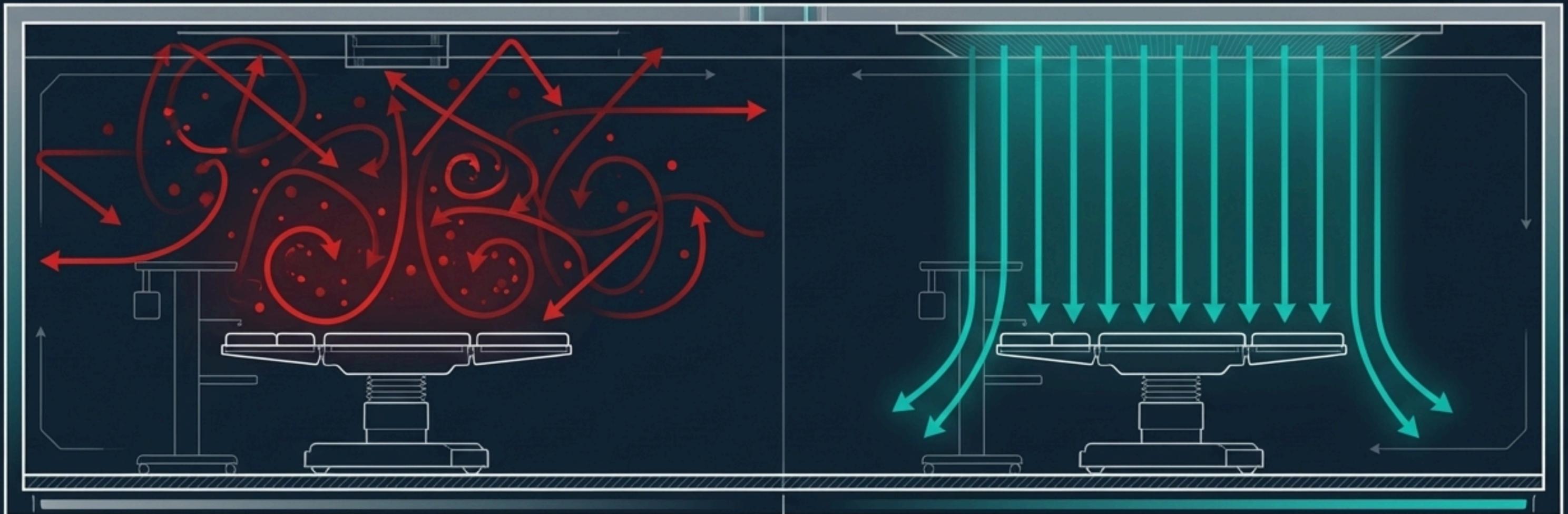


**ISO 7 General
Room Area**
Sora Regular

The Physics of Unidirectional Airflow

Laminar Air Flow (LAF) delivers a steady, unidirectional vertical stream of filtered air at velocities of $\sim 0.25\text{--}0.35$ m/s. This continuous downward pressure actively sweeps contaminants away from the surgical site rather than allowing them to circulate.

Turbulent Ventilation



Laminar Air Flow

Rapid Contaminant Removal Through High-Volume Air Exchanges

Standard Operating Theatre
20–25 Air Changes / Hour (ACH)



20–25 ACH

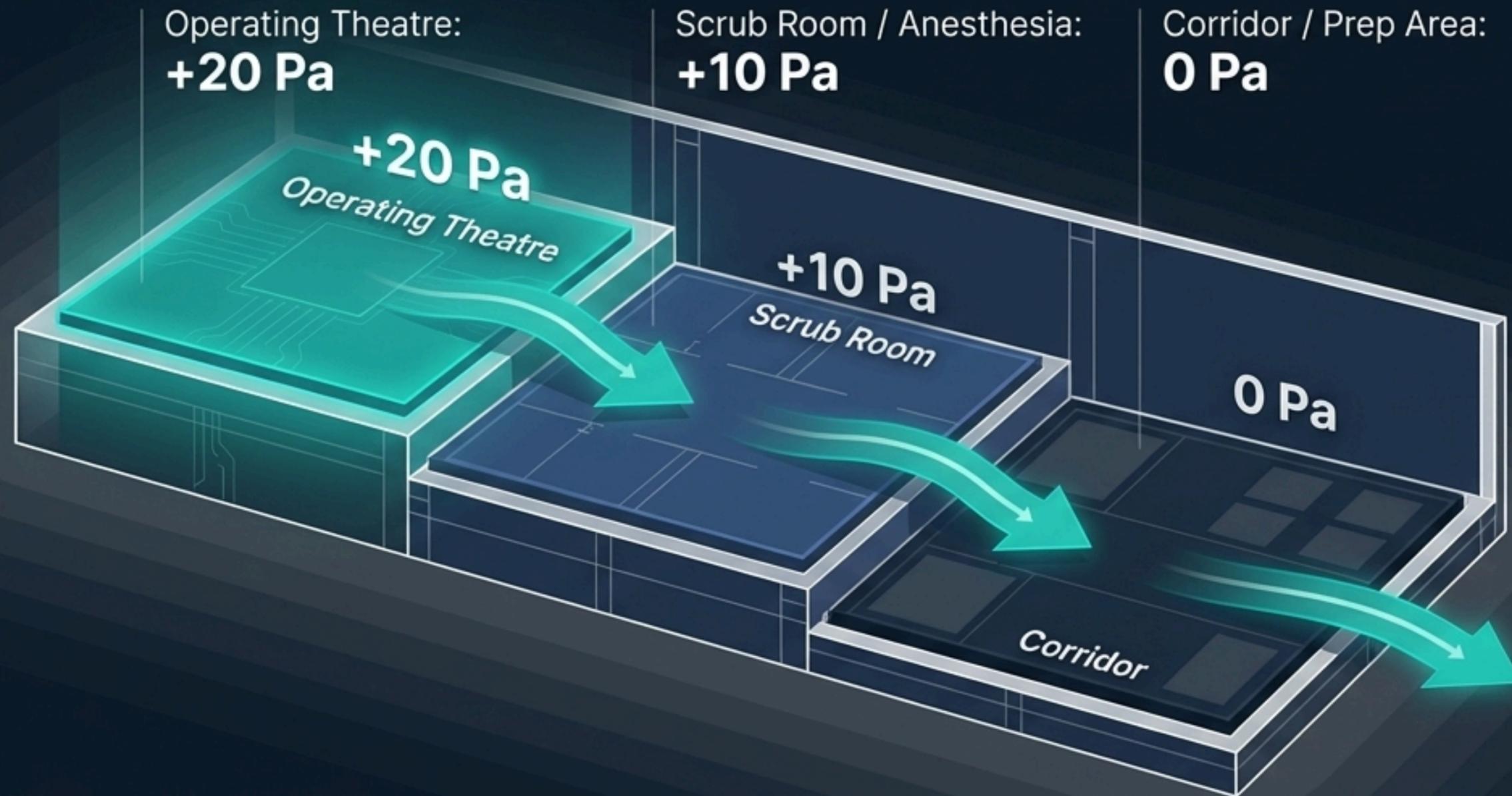
OPES ORION LAF Canopy Zone
300–600 Air Changes / Hour (ACH)



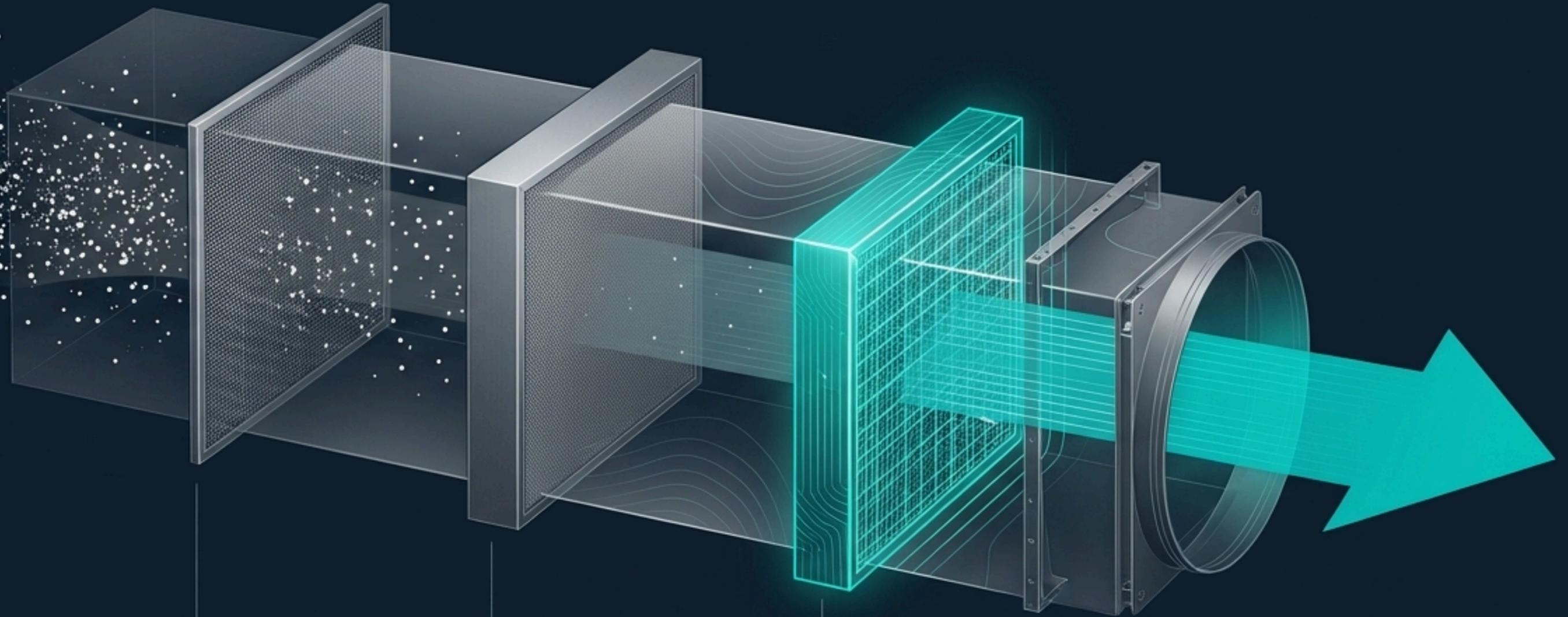
300–600 ACH

The Invisible Barrier of Positive Pressure

Cleanroom integrity relies on a strict positive pressure cascade. By maintaining the highest pressure in the most critical zone, air physically flows outward when doors open, ensuring contaminated corridor air can never enter the sterile environment.



Multi-Stage Filtration Drives Air Purity



Stage 1: Pre-filter (G4)

Captures large dust and macroscopic debris.

Stage 2: Fine filter (F7 / F9)

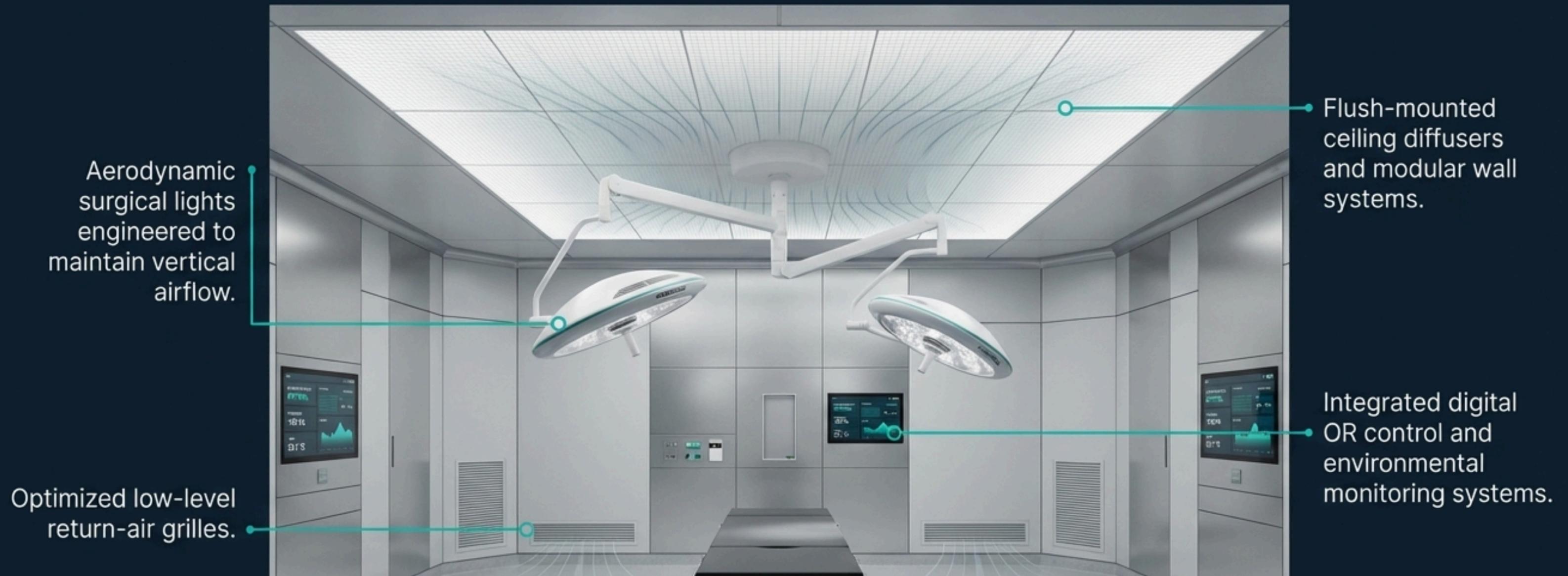
Captures smaller particulates and protects the final stage.

Stage 3: HEPA (H13 / H14)

The critical barrier. Captures 99.97% of all particles down to 0.3 μm , including airborne bacteria and pathogens.

Seamless Integration Preserves the Airflow

A **Laminar Air Flow system** only functions if the physical environment respects the air pathway. OPES ORION integrates modular architecture and specialized equipment designed to prevent turbulence.



Unbroken Accountability from Design to Commissioning

1. System Design & MEP Engineering



2. Precision Equipment Supply



3. Modular Installation & Integration



4. Testing, Commissioning & Long-term Maintenance



1. System Design & MEP Engineering

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2. Precision Equipment Supply

Precision equipment precisxn: precision-manufactured supply, with a based process initiated productors.

3. Modular Installation & Integration

Assembly Installation hærnp modular process toimtrebdate development in as to moduloiris and rotarion process.

4. Testing, Commissioning & Long-term Maintenance

A Testing, Commissioning & stop maintenance wit diagnostic and forces as a premium, hand-crafted diagnostic document.

Engineered to Meet International Healthcare Standards



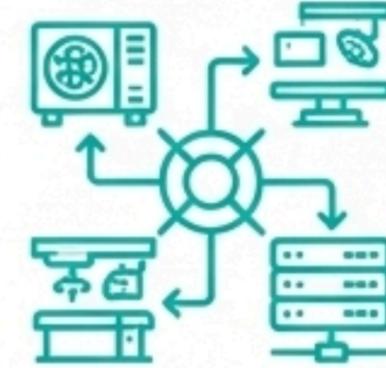
Healthcare Infrastructure Expertise

Decades of specialized experience in hospital engineering, MEP design, and critical care environments.



Strict Regulatory Adherence

Systems designed explicitly to meet and exceed global healthcare ventilation requirements and infection control guidelines.



Integrated Hospital Delivery

Seamless combination of cleanroom HVAC, modular operating theatres, and digital hospital infrastructure.

Build a Safer Surgical Environment

Partner with OPES ORION to design and implement a cleanroom solution that meets international healthcare standards and protects your most critical spaces.

[Talk to Our Healthcare Engineering Team](#)

References & Technical Standards

[ISO 14644-1](https://www.iso.org/standard/14644.html)

<https://www.iso.org/standard/14644.html>

Cleanrooms and associated controlled environments — Classification of air cleanliness by particle concentration.

[EN 1822](https://standards.iteh.ai/catalog/standards/cen/en-1822)

<https://standards.iteh.ai/catalog/standards/cen/en-1822>

High efficiency air filters (EPA, HEPA and ULPA) — Classification, performance testing, and marking.

[MOH Malaysia Guidelines](https://www.moh.gov.my/guidelines/ot-hvac)

<https://www.moh.gov.my/guidelines/ot-hvac>

Parameters for Operating Theatre HVAC design, airflow velocity, and differential pressure cascades.