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Cleanrooms

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Introduction

Cleanrooms or controlled environments are spaces designed to maintain specific levels of particulate contamination, temperature, humidity, and differential pressure, in accordance with international standards such as **ISO 14644.** These environments are essential for production and research processes in sectors such as pharmaceuticals, medical devices, microelectronics, biotechnology, laboratories, and healthcare facilities, where environmental control is essential to ensure process quality and product integrity.

Electrotécnica provides comprehensive solutions for the design and implementation of cleanrooms and controlled environments, combining modular construction systems, specialized HVAC and filtration technologies, environmental monitoring instrumentation, and specialized technical services. Our approach integrates engineering, equipment selection, installation, and technical support, enabling the development of solutions tailored to the specific requirements of each project and aligned with international best practices in contamination control.

Precise control
of particles, temperature, humidity, and differential pressure.

Compliance
with international standards such as ISO 14644.

Comprehensive solutions
design, engineering, implementation, and technical support.

Environmental monitoring
real-time instrumentation for control.

Key sectors
Pharmaceuticals, medical devices, microelectronics, biotechnology, laboratories, and hospitals.

Cleanroom Classification According to ISO 14644

Cleanrooms are classified according to the maximum allowable concentration of airborne particles, in accordance with the international standard **ISO 14644-1.** This classification defines the levels of cleanliness required for different industrial processes and applications.

In general, the most common applications include:

- **ISO Class 8:** General production areas, electronics assembly, and support areas in pharmaceutical facilities.
- **ISO Class 7:** Controlled pharmaceutical processes, specialized laboratories, and medical device manufacturing.
- **ISO Class 6 – ISO Class 5:** Microelectronics processes, advanced biotechnology, and critical sterile production areas

The modular solutions and HVAC systems presented in this catalog can be configured to meet the classification requirements corresponding to each project.

Cleanroom Classification According to ISO 14644

The cleanroom and controlled environment solutions presented in this catalog are designed for applications across multiple industrial sectors, including:

Application Sectors

- Pharmaceutical industry.
- Medical device manufacturing.
- Microelectronics and semiconductors.
- Biotechnology and research laboratories.
- Food and nutraceutical industry.
- Hospitals and clinical laboratories.
- Aerospace and precision optics industry.

Each sector presents specific requirements related to environmental control, cleanliness classification, and airflow design, which are considered during the design and implementation of each project.

Typical Configuration of a Modular Cleanroom

Modular cleanrooms are composed of different subsystems that work together to maintain the required environmental conditions. The main elements include

- **Modular construction systems** (panels and structural frameworks).
- **Specialized HVAC systems** for temperature, humidity, differential pressure, air exchange, and controlled airflow
- **HEPA or ULPA filtration** for particle control.
- **Access control systems** and personnel and material airlocks.
- **Specialized lighting** for controlled environments
- **Environmental** monitoring instrumentation.
- **Automation and monitoring systems through BMS.**

The proper integration of these components ensures compliance with the cleanliness levels required by international standards.

1. Modular Panels and Structural Systems

Construction solutions for sanitary enclosures and self-supporting structures used in cleanrooms and controlled environments. We offer different materials and configurations tailored to the specific requirements of each area and the particular needs of each project.

Subcategories:

- Modular sandwich panels (PU, PIR, EPS, mineral wool).
- Suspended ceiling panels.
- Sanitary profiles and joints (H, U, corner profiles, curved skirting).
- Installation accessories and sanitary sealants.
- Metal structures and self-supporting frames

Reference manufacturers:

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2. Doors, Windows, and Transfer Boxes

Doors: Door systems designed for use in cleanrooms and controlled environments. They feature double perimeter sealing as well as thermal and acoustic insulation properties. Doors can be manufactured in different dimensions and configurations, including variations in materials, finishes, locks, and accessories, according to the specific requirements of each installation.

Transfer Boxes (Pass Boxes): Equipment used for the controlled transfer of materials between clean areas and unclassified areas, with the objective of reducing door openings and minimizing the risk of cross-contamination.

These systems may **incorporate mechanical or electronic** interlocking mechanisms that prevent both doors from opening simultaneously. Depending on the application, they may include UV lamps for disinfection processes.

Doors Transfer Boxes

Cleanroom integration

Solutions that guarantee safety, airtightness and contamination control at every access and transfer point.

2. Doors, Windows, and Transfer Boxes

Access systems designed to maintain **airtightness and pressure control.**

Subcategories:

- Airtight swing and sliding doors.
- Automatic doors with interlocking systems.
- Flush-mounted double-glazed windows.
- Static and dynamic pass boxes.
- Electronic airlock and access control systems.

Types of Pass-Box

2. Doors, Windows, and Transfer Boxes

Components for Automatic Door Systems

Automatic door systems used in cleanrooms and controlled environments are designed to ensure safe and efficient access while maintaining the required airtightness and contamination control conditions. These systems integrate various mechanical, electrical, and control components that enable reliable and secure operation, fully compatible with the requirements of controlled environment facilities, facilitating the movement of personnel and materials without compromising the integrity of the clean area.

Sliding Door Guide

Heavy-duty guide system designed to ensure smooth and secure door movement. It incorporates an anti-detachment design, a direct current (DC) servo motor, and a dust-protected transmission belt, ensuring stable and reliable operation in controlled environments.

Multiple Control System

Control system that enables different door operating modes, including activation by radar sensor, manual push button, or integration with automated systems. It can be configured to operate with access control systems, AGVs, or other facility automation systems.

Safety Protection

Anti-pinch safety protection system that detects obstacles during door movement, stopping or reversing operation to prevent accidents. The sensor can be installed visibly or discreetly integrated into the door structure, maintaining both safety and the aesthetic appearance of the system.

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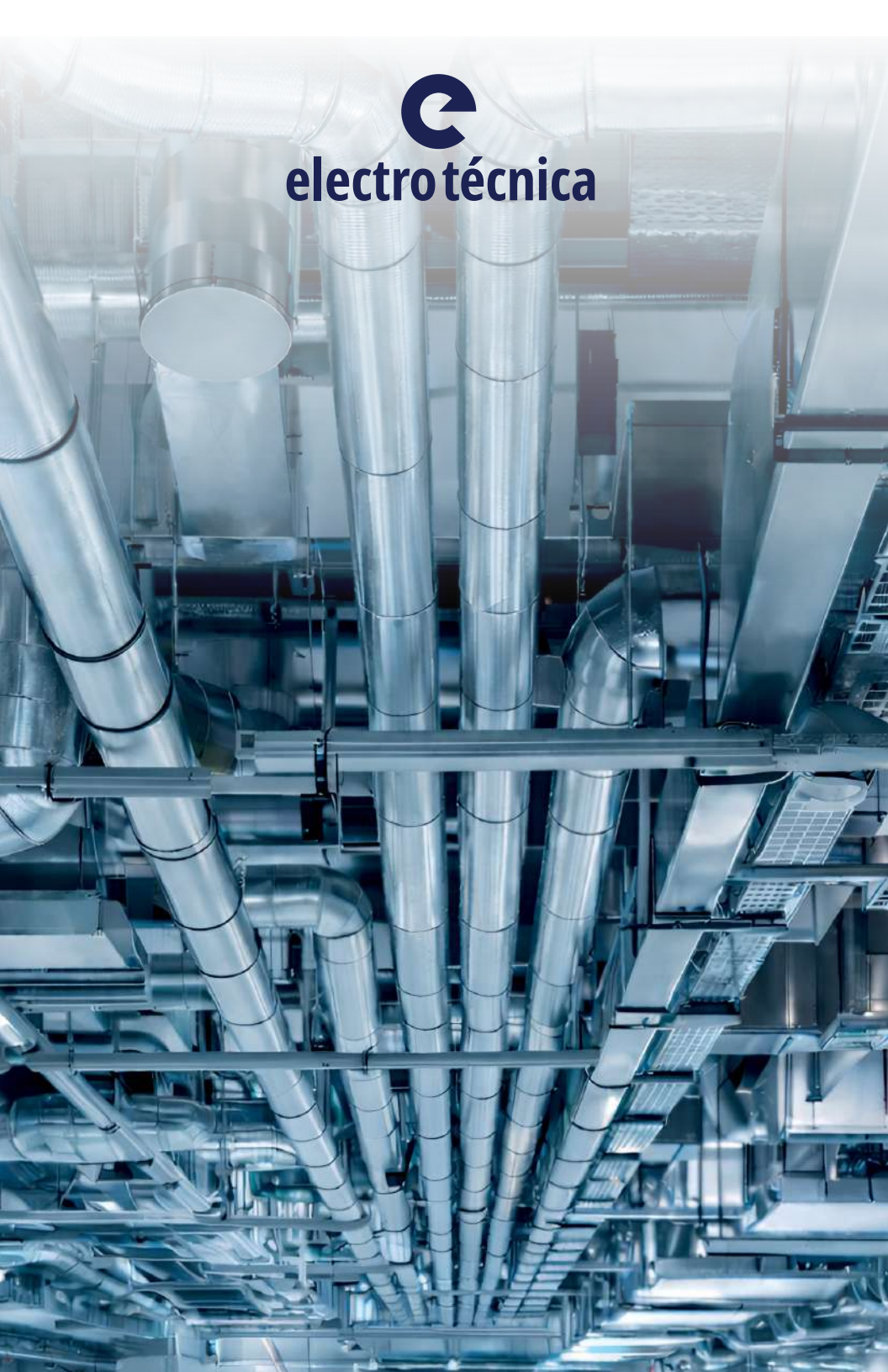

3. HVAC and Filtration Systems

HVAC systems for cleanrooms are essential to ensure the environmental conditions required in industries such as pharmaceuticals, medical devices, electronics, laboratories, and other applications that require strict contamination control.

These units are designed to integrate multiple functions within the HVAC system, including cooling, dehumidification, heating, humidification, air filtration, and purification. Thanks to their modular design and the incorporation of specialized components, they allow flexible installation, efficient operation, and precise control of critical parameters such as temperature, humidity, differential pressure, and air quality.

Subcategories:

- Modular Air Handling Units (AHU).
- Terminal Fan Filter Units (FFU).
- Prefilters and HEPA/ULPA filters.
- Terminal diffusers and air distribution grilles.
- Compact condensing units / chillers
- Ductwork, dampers, and airflow control valves.

Manufacturers we have access to:

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HiRef Innovators above the standards

TRANE®

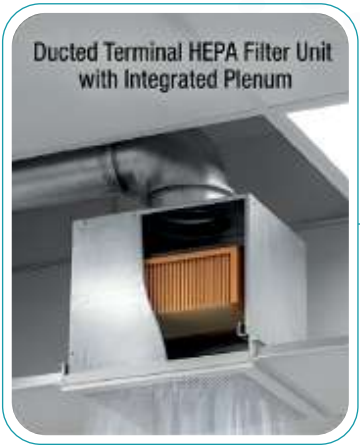
Modular solutions that guarantee controlled environments, high efficiency, reliability and compliance with the highest quality standards.

3. HVAC and Filtration Systems

The **HEPA filter box** is a terminal filtration unit used in ventilation systems for cleanrooms and controlled environments. It consists of a **static pressure chamber, a HEPA filter,** and a diffuser panel that allows air to be distributed uniformly within the clean area.

These units can be manufactured in different **materials and finishes,** including cold-rolled steel, stainless steel 201 or 304, and powder-coated steel, depending on the project requirements and installation conditions. They are typically installed at ceiling level, where the integrated HEPA filter provides the filtration level required to meet the specified cleanliness classification.

Its design allows **homogeneous distribution** of filtered air within the space, contributing to maintaining the required cleanliness conditions and particle control in the environment.



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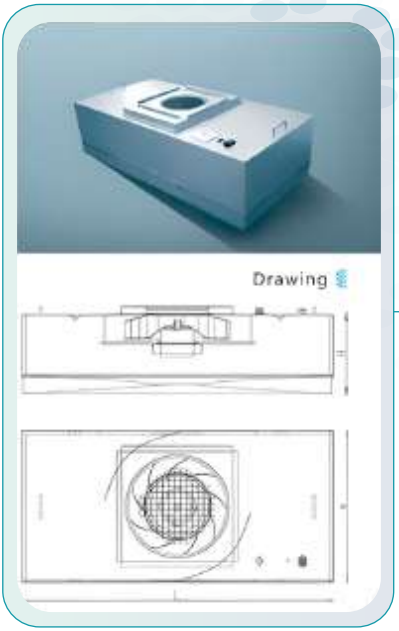
Fan Filter Unit (FFU)

The Fan Filter Unit (FFU) is a **modular air supply device** used as a **terminal element** in ventilation systems for cleanrooms and controlled environments. It integrates a fan and a high-efficiency **filtration system within a single unit.**

Air is drawn from the top of the unit by the fan and passes through a **two-stage filtration system** consisting of a prefilter and a **high-efficiency filter (HEPA).**

The filtered air is then delivered into the working area, providing **uniform airflow** and contributing to **particle control** within the environment.



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Filtration solutions that guarantee better control of critical environments.

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4. Airlock and Access Control Equipment

Equipment designed to control the movement of personnel and materials between areas with different cleanliness levels, helping to reduce contamination and maintain the required environmental conditions within the cleanroom.

Subcategories:

- Air showers.

4. Airlock and Access Control Equipment

Automatic Door Air Showers.

Automatic door air showers are installed at **access points between clean areas and unclassified areas,** making them particularly suitable for large facilities or areas where frequent movement of personnel or materials is required.

These systems typically use sensor-based **automatic door mechanisms,** eliminating the need for manual door operation and facilitating the movement of personnel or goods.

During operation, **high-velocity air jets** remove particles adhered to the surfaces of clothing, equipment, or materials before entering the clean area, helping maintain cleanroom **contamination control conditions and improving operational efficiency.**

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5. Environmental Monitoring and Instrumentation

Equipment designed for the measurement, recording, and continuous monitoring of critical environmental parameters within cleanrooms and controlled environments. These systems enable verification of compliance with required operating conditions and facilitate the management and control of variables such as particle concentration, temperature, relative humidity, and differential pressure.

Subcategories:

- Portable or fixed particle monitors.
- Temperature, humidity, and differential pressure sensors.
- Environmental monitoring systems integrated with BMS (**Building Management System**) platforms.

Manufacturers we have access to:

BMS

Honeywell

EMS/CMS:

VAISALA

Predictive maintenance Software with IA:

elipsa

Instrumentation:

Dwyer

Phoenix Controls

VAISALA

SENVA
Sense the Difference

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6. Prefabricated Modular Cleanroom Solutions

Integrated prefabricated cleanroom solutions designed to provide controlled environments with different classification levels. These modular configurations allow rapid installation and offer flexibility to adapt to the specific requirements of each process or facility.

Modular cleanrooms can be configured as complete systems integrating structural panels, HVAC systems, filtration, lighting, and environmental control, ensuring compliance with operational requirements and the cleanliness classifications established by international standards.

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Subcategories:

- ISO 8-7 cleanrooms with integrated HVAC.
- Portable modules and cleanrooms in ISO-type containers.
- Mini cleanrooms and laminar flow workstations.
- Weighing booths and sampling booths.

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7. Specialized Lighting for Cleanrooms

A range of ligth fixtues specifically designed for installation in cleanrooms and **controlled environments.** These lighting systems are developed to meet the requirements of facilities classified according to **ISO 14644**, providing uniform illumination while minimizing particle generation.

The luminaires are manufactured with materials and sealing systems designed to **prevent the accumulation of contaminants** and to facilitate cleaning and maintenance tasks. They are commonly used in pharmaceutical manufacturing facilities, medical device production, microelectronics, and other applications that require **strict contamination control.**

KENALL

8. Electrical Distribution

We provide a wide range of products for UPS, Diesel Generators and electrical power distribution, such as distribution panels, substations, busway, transformers, medium-voltage equipment, capacitor banks, voltage regulators, lighting control, among others—plus accessories and devices for controlling and monitoring your infrastructure's auxiliary systems.

Some of manufacturers we have access to:

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EATON Powering Business Worldwide

VERTIV.

ABB

modasa

rehlko

9. Services and Technical Support

Our portfolio of services is designed to support clients throughout the entire lifecycle of their cleanroom and controlled environment facilities, ensuring that each solution meets high standards of performance, reliability, and regulatory compliance. From the supply of modular components, specialized structures, and critical cleanroom systems to the installation and commissioning of equipment, our technical teams manage every stage of the project with rigorous supervision to ensure that the controlled environment is delivered fully operational and in accordance with the client's requirements.

In addition, we provide installation and configuration services for BMS (Building Management System) platforms, enabling centralized monitoring and control of critical parameters such as temperature, relative humidity, differential pressure, and air quality. These solutions facilitate real-time supervision and seamless integration with the existing infrastructure of the facility.

As part of our post-implementation support, we also develop preventive and corrective maintenance programs tailored to the specific needs of each project. These programs include periodic inspections, filter replacement, system verification, and technical response to potential incidents, helping to maintain the required operating conditions and cleanroom classification. Together, these services form a comprehensive support framework aimed at ensuring operational continuity and optimal facility performance over time.

Certifications:

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ISO 9001:2015

9. Extensive experience in the life sciences sector

Boston Scientific · Baxter · CooperSurgical · MOOG · samtec · Coloplast
BIOMERICS · AstraZeneca · Zollner · HOLOGIC · Abbott · MOOG
Edwards · CardinalHealth · CooperVision · icumedical · BOURNS · PHILIPS

Certifications

UL · ABNT · CSA · ATD · ATS · AOS · PMI · LEED AP BD+C
uptime INSTITUTE · Bicsi · U.S. Green Building Council LEED · ISO 9001:2015 · LEED GREEN ASSOCIATE · NFPA · Somos Exportadores COSTA RICA

The brands and manufacturers shown are references to technologies or suppliers that may vary depending on availability, technical requirements, and the scope of each project.


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