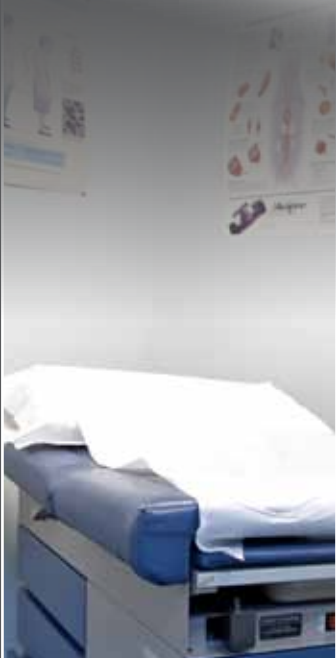




critical environment diffusers

clever. creative. comfort.



Titus
The Leader in Air Management

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Vision

Since 1946, we at Titus have had the distinct privilege of building on the legacy of our founder, Don Titus' solid foundation of innovation, quality products, quality service and quality employees. Our goal is very clear - to help the people who depend upon us by continuing to innovate and advance the science of air distribution.

We are guided in this work by our commitment to significantly improve the health, efficiency, comfort and aesthetics of the environments in which our products are used. The primary guiding principle we follow is the belief that the ethical way is the only way to conduct our business. Actions speak louder than words. Our focus on every phase of our business contributes to our ability to better serve our customers and provide the best products and solutions.

A SPIRIT OF SERVICE

To lead is to serve. By listening to our customers and those they serve, we gain a better focus on the needs

which we can best satisfy. Our business purpose is to serve our customers and the industry as a whole. We serve them with products that are innovative and more effective than those offered by our competitors. Our quality is evident in the ever-increasing product lines and service to our customers.

The Titus of tomorrow will be larger and more robust than it is today, as has been the case since 1946. As Winston Churchill said "To improve is to change; to be perfect is to change often." Titus will continue to change, but always with a focus on a spirit of service and surpassing the needs of the commercial HVAC industry world wide.

STABILITY

We are fully dedicated to serving the HVAC industry through the finest Representative firms. Our long term partnership with our representatives and our mutual commitment with them is ultimately the key to our



success. This results in stability in the market place unmatched by any other manufacturer.

Why has Titus continued to lead the industry for over 65 years? Our employees are viewed as having unique individual value with dignity and worth independent of the work they do. Each employee has a real sense of unity and commitment to the other, each contributing their invaluable work, so that their collective efforts result in Titus continuing to set the standard for excellence in the industry.

Titus dedicates itself to be a company which looks forward to anticipate the needs of HVAC professionals and the people they serve. This dedication is based on our mission - to help HVAC professionals deliver better products and services, and to make life better for those who use our products.

INNOVATION

Intelligent Innovation has been and will continue to be our hallmark. Many products inevitably face the cycle of growth, maturity, and decline due to changing market needs. Titus has made an unwavering commitment to improve existing products and develop or acquire new and unique products and technologies.

At Titus, we don't take our success for granted. Our employees know that success only comes through hard work, a commitment to excellence and a desire to make a difference in all that we do. We are proud of our achievements and will continue to work hard to deliver on our commitments.



Innovation

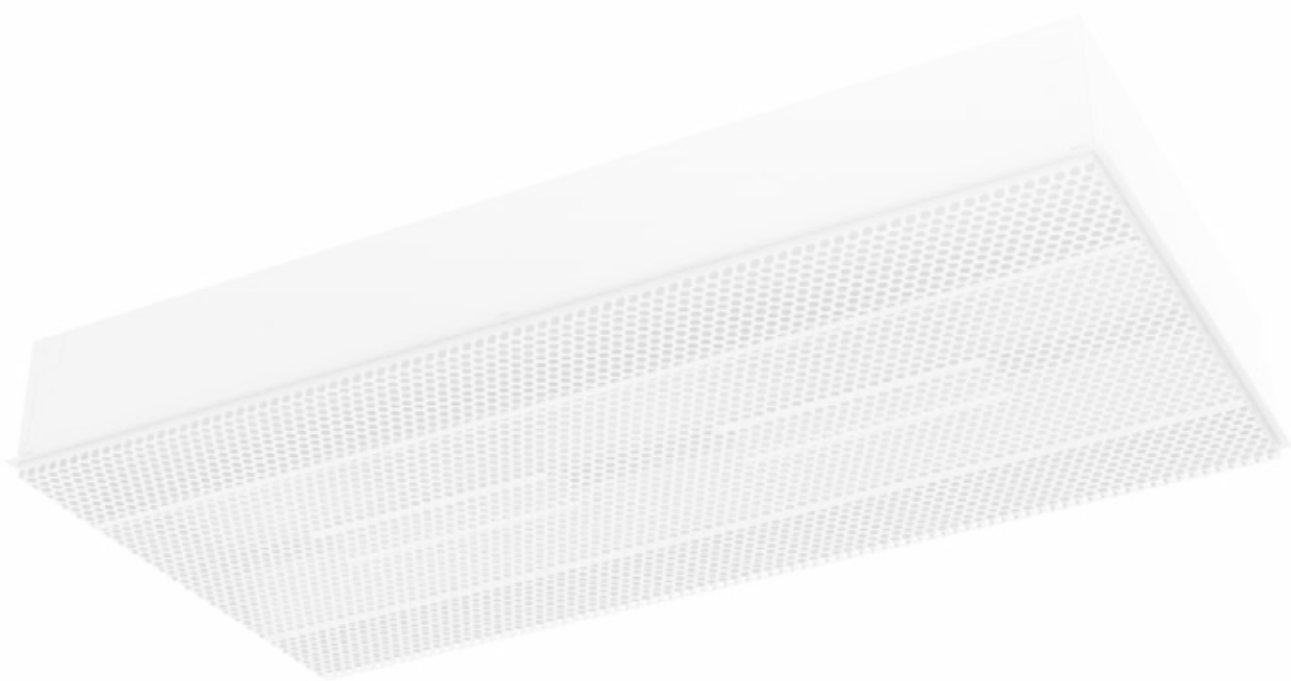
For over 65 years, the name Titus has been synonymous with innovation in commercial air distribution. Many of the solutions we have developed over the years are still tried and true core products in our industry today. *Intelligent Innovations* speaks to our ability to solve problems and look at air distribution in new ways. Our true passion, however, lies in our ability to find clever and creative ways to enhance occupant comfort. *Clever. Creative. Comfort.*

Several examples can be found within the pages of this catalog, and one of the stand-out products is the EOS; the industry's first solar-powered, energy-harvesting auto-changeover diffuser. Not only does the EOS provide THE solution for perimeter heating and cooling challenges, but it decreases the time it takes for an occupied zone to reach the setpoint, over the traditional split compromise diffuser, to improve occupant comfort. Additionally, the technology at work in the EOS provides us with a scalable energy

harvesting platform to use as a jumping off point to address thermal comfort in revolutionary ways.

Another clever and creative example innovation from Titus is the Plexicon. Displacement ventilation, while a great solution for cooling a space, usually requires a separate or supplementary system for heating; which affects the design, installation and overall cost of a project. The Plexicon addresses this challenge by incorporating displacement cooling and mixed-airflow heating into a single diffuser assembly with auto-changeover action. Providing both cooling and heating from the same diffuser eliminates the need for a secondary heating system, reduces overall project costs, and delivers a high level of thermal comfort to the building occupants.

At Titus, we are continually working on developing new ways to advance the science of air distribution.





Training

Titus has long been recognized as a provider of world class training for the air distribution industry. Our various seminars, most notably our Consulting Engineer classes, provide students with valuable instruction in such areas as the Basics of Air Distribution, Energy Solutions, ASHRAE Standards and achieving LEED accreditation.

Titus training provides practical information that can be applied to current projects or applications. Our training is highly interactive with hands on product demonstrations and technology-driven displays. We offer the opportunity to see products in action to help engineers understand the best applications for each product type or system.

Titus' industry experts utilize our state-of-the-art lab and R&D facility as a backdrop for many of the sessions, and our participants consistently walk away from our classes with a broader understanding of air

distribution and the solutions we offer.

At Titus, we highly value our time with customers, particularly the engineers specifying our products, because they allow us to forge lasting relationships that give us valuable insight into the day-to-day challenges they face.

Whether you are experienced or new at designing with HVAC, Titus training allows you to expand your HVAC knowledge.

GREEN SEMINAR

- » LEED
- » UnderFloor Air Distribution
- » Displacement Ventilation
- » Chilled Beam



CONSULTING ENGINEER SEMINARS

- » Displacement Ventilation and Chilled Beam Products
- » Air Distribution Product Selection & Application
- » Terminal Unit Product Selection & Application
- » Personal Comfort with Access Floor and VAV Diffusers
- » Terminal Unit Controls and Applications
- » Critical Environment Diffuser Applications
- » Applied Acoustics (Lw, Lp, NC & RC)
- » Air Distribution Patterns/Principles of Overhead Heating & A.D.P.I.
- » Characteristics of Throw and Selection for Optimum Comfort
- » Selecting and Applying HVAC products for LEED



Energy Solutions

Green Building design and energy conservation concepts are not new, yet in recent years the focus throughout the world has been to build structures with these principles in mind. We have seen the positive impact that designing and creating green buildings with these concepts have on our community and more importantly the world in which we live. As such, 100% of our focus for the past couple years and going forward has been on developing and delivering Green Solutions, and not just any Green Solution, but relevant Green Solutions. This is exactly the purpose of the Titus Energy Solutions website.

The Energy Solutions micro-site is a first of its kind for any HVAC manufacturer in the industry. Our tagline, *The Leader in Air Management* is not just words. Titus is fully committed to provide the latest innovations to the HVAC market and this new website is just another piece to an ever-growing puzzle. By being singularly focused on Green products and Green Building concepts, this

website provides a portal into the latest developments in training, design, energy conservation, and news that directly affect us. We made every effort to incorporate all the tools needed to find the perfect Green Solution.

Within the site you will find relevant product information, marketing collateral, LEED tools and other energy conservation related resources. We offer a wide array of Green products that can be used in a variety of applications. Whether you have a ceiling application or an underfloor installation, Titus has the Green Solution for you! Many of our products are GreenSpec Listed and we have a knowledgeable and experienced staff of industry professionals ready to provide assistance when needed.

The marketing collateral we have made available on the Energy Solutions site is directly related to our Green products as well. The Energy Solutions Brochure and the Retrofit Energy Solutions Guide are two brochures



created to focus on Green products. The Energy Solutions Brochure is a 4-page guide that not only shows the types of products we offer, but highlights what LEED Credits they assist in achieving. The Retrofit Energy Solutions Guide provides a more thorough look into how an older building can be retrofitted and the energy savings available if new system or components were to be installed.

We have also completely revamped our case studies to provide a more in-depth perspective into some of our Green projects. They illustrate the overall design process from concept to completion. Our case studies also display which Titus products were selected and highlights how they solved the project's air distribution needs. We also have flyers, green presentations, installation manuals, and application guides available on the site.

The HVAC system plays a vital role in achieving healthy

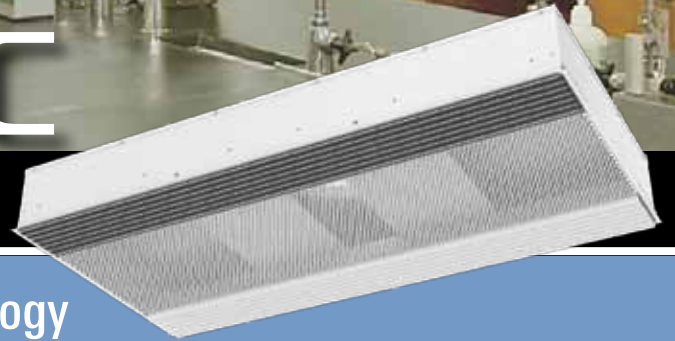
buildings to work in, but the LEED Credits associated with them tend to be missed. The sections of LEED that directly relate to Titus' air distribution products primarily fall under Energy & Atmosphere (EA) and Indoor Environmental Quality (EQ) sections of LEED. The U.S. Green Building Council's Leadership in Energy and Environmental Design standard (LEED) has quickly become the basis for determining a building's "Green" status.

Our goal in creating the Energy Solutions website is to provide you with a very informative and green-focused interactive resource for today's demanding building needs. Sustainable design and energy conservation concepts are here to stay and this new tool will assist you in meeting those demands.

- Uses specially formed adjustable blades for maximum free area and directional throw.
- High airflow capacity (200 to 1,000 cfm).
- Available in 24 x 24-inch or 48 x 24-inch module sizes.
- Internal air baffling to equalize airflow across the face of the diffuser.

VersaTec

CLEVER. CREATIVE. COMFORT.




Hemispherical Air Diffusion Technology

VersaTec models feature adjustable pattern control technology for delivering high volumes of low velocity air in a radial pattern. Each model is constructed using adjustable blades which allow adjustment of the discharge air pattern. Two versions of this model are available; VersaTec with an optional adjustable blade face and VersaTec with a perforated center section. VersaTec diffuser blades hang less than 1-inch below the ceiling.

These diffusers are an excellent choice for Class 1,000 to 100,000 rooms. Applications include cleanroom environments such as labs with exhaust hoods, pharmaceutical manufacturing and biotechnology research.





THE LABORATORY SOLUTION FROM TITUS

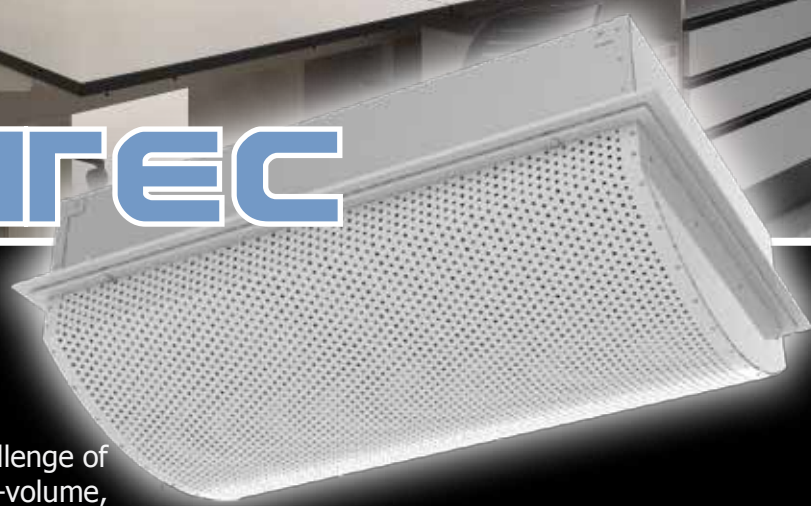
RADIA TEC

Radial Air Diffusion Technology

The RadiaTec diffuser is designed to meet the challenge of diluting airborne contaminants by supplying high-volume, low-velocity airflow to displace these impurities. The airflow pattern is designed to produce a uniform pattern to prevent dead spots where contaminants can linger and to limit the air pattern penetration into the habitable zone.

The RadiaTec creates a full pattern along the face of the diffuser, and when mounted end-to-end, throw is not increased. The RadiaTec's high induction rate draws impurities into its airstream, allowing it to be diluted to less harmful levels prior to exhausting the air.

Applications include labs with exhaust fans, pharmaceutical manufacturing, biotechnology and other applications where high air volume with short flow are required. It is an excellent choice for Class 1,000 to 100,000 rooms.



CLEVER. CREATIVE. COMFORT.





SteriTec

STERILE ENVIRONMENT SYSTEM TECHNOLOGY

CLEVER. CREATIVE. COMFORT.

The SteriTec system combines the features of the TLF and the LineaTec to form a clean zone within a clean room. A typical SteriTec system for a class B or C operating room includes a LineaTec perimeter air curtain and with TLF laminar flow diffusers as the central supply air outlets.

Contaminated air outside the air curtain is prevented from entraining or being mixed with the clean zone created and inside the LineaTec diffusers zone. Return grilles are located at the low level sidewall as exhaust outlets on at least two of the room's walls. These are typically mounted so the lower portion of the grille frame is about 8 inches above the floor to allow cleaning of the room's floor.

- Blades have minimum adjustability to allow precise control of the air curtain angle.
- Two-slot perimeter air curtain for creating an air wall between clean zones and adjacent area.
- Face quickly removes for easy plenum access.
- No retainer cables.



- Ideal for installation in hospital operating rooms.
- Compatible with 1-inch or 1 1/2-inch T-bar ceiling grids.
- Available in steel, aluminum or 304 stainless steel.
- Internal baffles to distribute air evenly over perforated face.



TLF

VERTICAL LAMINAR FLOW TECHNOLOGY

TLF laminar flow diffusers are the industry standard for unidirectional flow. When unidirectional flow is desired, typically in areas classified as 1 to 1000, TLF is the choice. TLF diffusers can be used to create clean zones by positioning the diffuser directly over the area to be washed with clean air. Clean zones are typically used as process areas within a clean room.

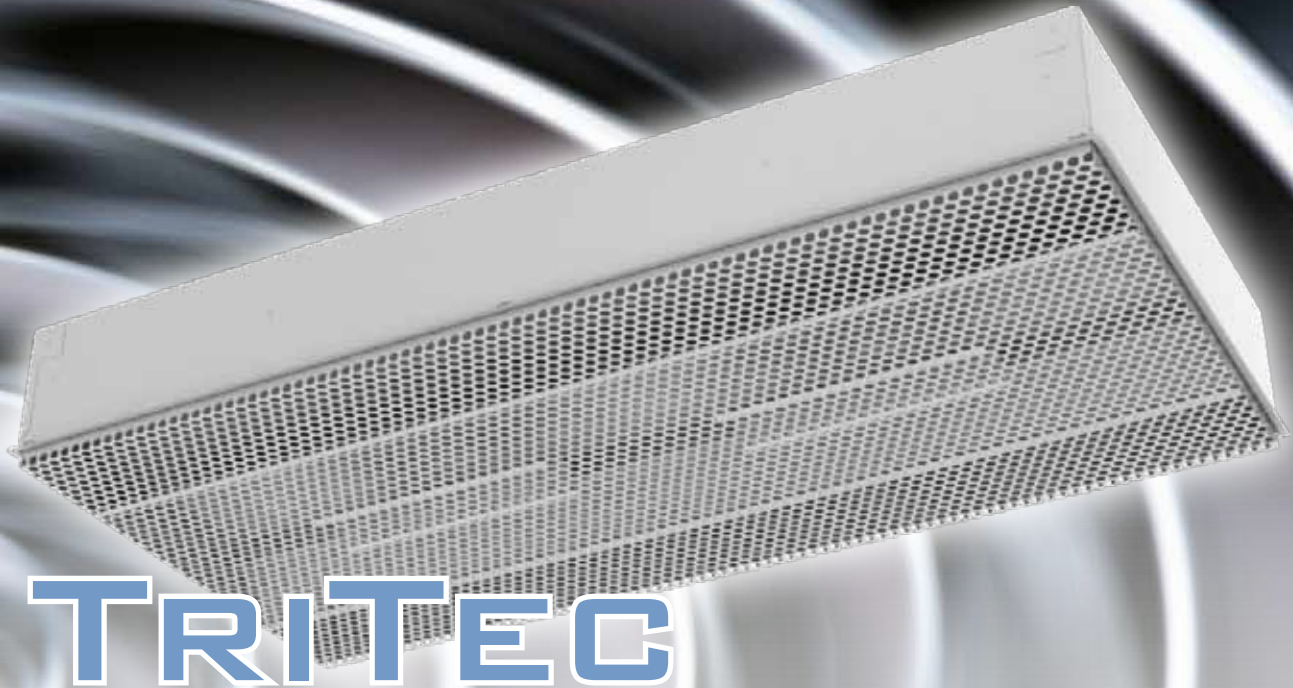
TLF diffusers are also used in most operating rooms as the center diffuser and many times these diffusers are surrounded by a linear air curtain. The vertical piston of air created by the TLF is used to discharge clean air over the patient during operations.

TLF is especially effective in cooling areas with heavy, localized, internal loads, as in computer rooms. The column of air delivered by the TLF cools the load source directly without generating high velocities in the occupied space.

CLEVER. CREATIVE. COMFORT.



CLEVER. CREATIVE. COMFORT.



TRITEC

Radial Air Diffusion Technology

TriTec models are designed to allow large volumes of air to be introduced into the environment with very short throws.

Discharging airflow patterns of a two-way blow provide a 180 degree radial pattern, TriTec takes advantage of the maximum space available for distributing velocity. This results in the lowest possible velocities for the volume of air being delivered. Unlike competitive models, TriTec utilizes a 51 percent free area perforated face that hangs below the ceiling less than $\frac{5}{8}$ -inch. In appearance, TriTec models look like industry standard perforated diffusers.

TriTec's unique design allows it to create a full pattern in the middle of the diffuser as well as on the ends. The design of the TriTec allows these diffusers to be mounted end to end without increasing the throw.

Applications include labs with exhaust hoods, pharmaceutical manufacturing, telephone switching rooms, biotechnology research facilities and many other applications where high airflows with short throws are required. These diffusers are an excellent choice for Classes 1,000 to 100,000 rooms.





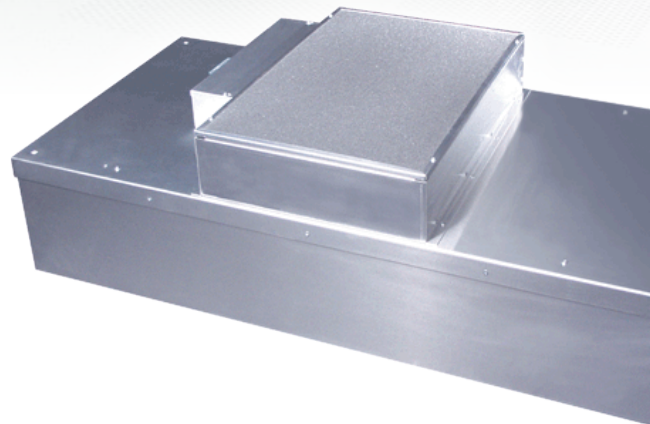
FAN FILTER DIFFUSERS

THE NEW CLEANROOM SOLUTION FROM TITUS

Low Energy, Low Sound, and Low Profile

Titus offers a complete line of Fan Filter Diffusers that can be used for new design or retrofitting cleanroom environments. Each Titus FFD (Fan Filter Diffuser) is a self-contained fan filter module that includes HEPA filter, pre-filter, fan speed control and low profile design. Air circulation is maintained by using a lightweight, forward curved fan powered by a 120V or 277V, 60Hz motor.

- Low profile design
- PSC or ECM motor
- Solid state, visual, or infrared speed control
- Walkable plenum (excluding prefilter)
- UL listed (120V, 277V)
- Standard sizes: 24" x 24" and 48" x 24"
- Aluminum construction (stainless steel optional)
- Options: Duct collar, challenge port, ULPA filter, power cord





REBECCA & JOHN MOORES UCSD CANCER CENTER

CLIENT:

University of California, San Diego

REPRESENTATIVE OFFICE:

Toro-Aire

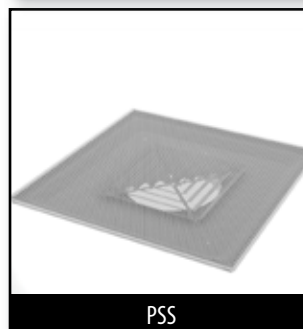
ABOUT THE PROJECT

The University of California at San Diego Cancer Center is a stunning achievement for teaching, treatment and research into the causes and hopefully cures of all forms of cancer. The patients who walk through these doors will have access to the most advanced care, in a state-of-the-art setting. The groundbreaking work of the physicians and scientists associated with the Moores UCSD Cancer Center will benefit its patients for generations to come.

The UCSD Cancer Center is a 270,00 square foot facility that houses clinical, research, educational, and outreach activities all under one roof. The center also includes a serene outdoor setting called the Garden of Hope. This tranquil, shaded bamboo garden can be used for dining and interaction with other patients. This location was designed specifically for the cancer patients to inspire hope and provide comfort during their treatment at the facility.



TriTec



PSS



FlowBar



ARCHITECT/DESIGNER:

Zimmer Gunsul Frasca Architects LLP

LOCATION:

San Diego, California

LEED CERTIFICATION:

None

THE TITUS SOLUTION

Providing air distribution solutions for critical environment or cleanroom applications is not new to Titus. We have been the industry leader for air management for many years. The products selected for the UCSD Cancer Center were the TriTec, the PSS and the FlowBar.

The Tritec diffuser is a high volume, low velocity unit that utilizes radial air diffusion technology to dilute airborne contaminants. The airflow pattern is designed to produce a uniform pattern to prevent dead spots where contaminants can linger. It is an excellent choice for Class 1,000 to 100,000 rooms. The Titus Series PSS perforated star diffusers generate a high induction air pattern that maximizes throw. The deflector is mounted directly under the neck of the diffuser to generate the long-throw star pattern. As a result, pressure drop and noise levels are lower than typical curved blade perforated diffusers.

The FlowBar architectural linear diffuser system maximizes engineering performance without sacrificing aesthetic considerations of the architects. FlowBar's outstanding performance allows higher airflows than conventional linear diffusers, with lower noise levels, making it ideal for high profile designs. The Flowbar system is available in continuous linear, incremental linear and square configurations.

THE END RESULT

The new building represents a new beginning for UCSD as an NCI-designated Comprehensive Cancer Center. It is a tribute to the commitment of the university to establish a world-class cancer center that fosters interdisciplinary research and brings the benefits of research directly to the community it serves. The center serves as the benchmark for future facilities to meet or exceed.



GEORGE WASHINGTON UNIVERSITY HOSPITAL

CLIENT:

George Washington University Hospital

REPRESENTATIVE OFFICE:

H&B Products Inc

ABOUT THE PROJECT

Patients and staff members at the George Washington University Hospital experience medical care in a comfortable and technologically advanced environment. Having opened its doors in 2002, the new six-story 417,000 square foot hospital serves a diverse group of patients - from area residents to visiting dignitaries and heads of state. Architects from Smith-Group and HKS collaborated to design a facility that not only offers multi-disciplinary, tertiary care and many other clinical services, but also blends well into the surrounding university campus and residential neighborhood.

THE TITUS SOLUTION

Air distribution in critical environment facilities is a key concern for all. Patients, doctors and visitors need to be secure in knowing the impurities in the air are being filtered out accordingly. Titus has several solutions that meet or exceed this expectation. The products selected for this hospital application were the



TLF-AA



355R



TMS



ARCHITECT/DESIGNER:

SmithGroup/ HKS Architects

LOCATION:

Washington, D.C.

LEED CERTIFICATION:

None

TLF-AA, the 355R grille and the TMS diffuser.

Titus' TLF-AA laminar flow diffusers are the industry standard for unidirectional flow. TLF diffusers can be used to create clean zones by positioning the diffuser directly over the area to be washed with clean air.

Clean zones are typically used as process areas within a cleanroom. TLF diffusers are also used in most operating rooms as the center diffuser and many times these diffusers are surrounded by a linear air curtain. The vertical piston of air created by the TLF is used to discharge clean air over the patient during operations. Laminar flow minimizes air induction, reducing the opportunity for contaminated air to be re-entrained and pollute a clean airstream.

The other products featured in this hospital project are the 355R grille and the TMS diffuser. The 355R grille has a 1/2" blade spacing with 35 degree deflection. The TMS diffuser is a square ceiling diffuser that delivers supply

air in a true 360 degree pattern with low pressure drop. The uniform, nearly horizontal jet from the outer cone maintains effective room air distribution even when the air volume varies over a considerable range. All sizes have three cones, giving a uniform appearance where different neck sizes are used in the same area.

THE END RESULT

The mission of the George Washington University Hospital is to provide high-quality healthcare, advanced technology and world class service to its patients in an academic medical center dedicated to education and research. Their new 96 million dollar facility will allow them meet this goal for many years to come.



SALEM HOSPITAL

CLIENT:

Salem Hospital Regional Health Services

REPRESENTATIVE OFFICE:

Air Commodities

ABOUT THE PROJECT

The new Salem Hospital Tower is a 352,000 square foot inpatient clinical tower that is Phase I in a collaborative effort to replace the old hospital. The new tower has 120 acute and critical beds, an emergency department, imaging facilities, cath labs, and provides surgical and logistical services. The landscaped gardens provide a tranquil setting for recovery and piece of mind during treatment.

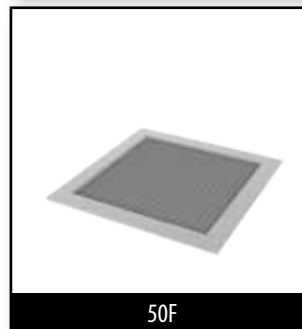
Providing high quality healthcare was the underlying goal in the design of the new tower. Heart patients will benefit from the new cardiovascular care unit. Instead of being constantly moved from room to room during the recovery process, patients will experience the "recover in place" concept in which their needs can be met in a single spacious room. The building also has accommodations for patients weighing up to 1000 pounds. The new inpatient rooms have lifts installed to help move patients as well as specially designed beds, bathrooms and furniture.



TLF



TMS



50F



D-75



ARCHITECT/DESIGNER:

HKS Architects

LOCATION:

Portland, Oregon

LEED CERTIFICATION:

None

THE TITUS SOLUTION

Titus provided several products that solved the air distribution requirements for the new tower. The TMS is a square ceiling diffuser that delivers supply air in a true 360° pattern. The uniform, nearly horizontal jet from the outer cone maintains effective room air distribution even when the air volume varies over a considerable range. All sizes have three cones, giving a uniform appearance where different neck sizes are used in the same area. Our 50F Eggcrate grille has the highest free area of any return grille. It is available in several core sizes. The D-75 Air Balancing Device mounts directly to the diffuser neck. This opposed blade damper has three sets of gang operated blades that distribute air evenly over the diffuser face.

The critical environment solution for the hospital was our TLF laminar flow diffuser. TLF diffusers can be used to create clean zones by positioning the diffuser directly over the area to be washed with clean air. They are also

used in most operating rooms as the center diffuser. The vertical piston of air created by the TLF is used to discharge clean air over the patient during operations.

THE END RESULT

The new Salem Hospital followed many design elements to create the best facility for its patients. The architects used evidence based principles and green building design elements during the construction. By placing the patient first, the finished hospital serves as a testament to what can be achieved when everyone involved collaborates with one common goal in mind.



VAN ANDEL INSTITUTE

CLIENT:

Van Andel Institute

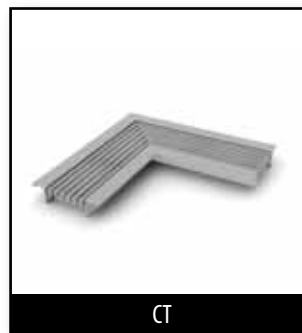
REPRESENTATIVE OFFICE:

Marshall & Wells Company

ABOUT THE PROJECT

The Phase II addition of the Van Andel Institute for Cancer Research opened on December 8, 2009. It's opening brought hope not only for the many cancer patients seeking cures, but the many jobs will definitely boost the economy in the city. This LEED Certified facility is located directly to the west of the existing structure. Spanning eight-stories high and totaling 240,000 square feet, the new addition triples the existing laboratory space and affords researchers the opportunity to find cures all types of cancers.

The new building features many energy efficient element. Some of the Green Building design principles utilized were photovoltaic panels, heat recovery systems, low-flow water fixtures that reduce water usage by 30%, and a 27,000-gallon rainwater storage tank. Additional concepts used were installing a lab air sampling and control system, lighting controls, using a glass roof design and open floor plans to maximize the abundance of natural light. The architects also used locally-manufactured materials in the construction process that rein-



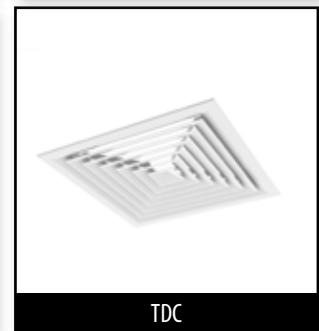
CT



TriTec-AL



RadiaTec



TDC



GREEN CASE STUDY

ARCHITECT/DESIGNER:

Rafael Viñoly Architects

LOCATION:

Grand Rapids, Michigan

LEED CERTIFICATION:

LEED Certified

forced their commitment to sustainability.

THE TITUS SOLUTION

To meet the needs of this new expansion project, Titus supplied many different air distribution solutions. To meet the needs of the additional laboratory spaces, Titus supplied the RadiaTec and TriTec diffusers. The RadiaTec is a dome faced radial diffuser and the TriTec-AL is a rectangular radial diffuser with an aluminum backpan. Both units work well in critical environment applications by diluting airborne contaminants with high-volume, low-velocity airflow to displace impurities. The airflow patterns are designed to produce a uniform pattern to prevent dead spots where contaminants can linger. They are an excellent choice for Class 1,000 to 100,000 rooms.

In areas where air distribution needs did not require a critical environment solution, the TDC and the CT were featured. TDC diffusers handle an unusually large amount

of air for a given pressure drop and noise level. Their pleasing appearance harmonizes with various architectural details, especially in modular ceiling systems. CT linear bar diffusers are designed for both heating and cooling applications, supply as well as return. Available in eight different core styles plus a wide selection of frames and borders, these diffusers can be used for ceiling, side wall, or sill installations. Accessories such as directional blades, dampers, blank-offs, access doors and mitered corners make these diffusers even more versatile.

THE END RESULT

The Van Andel Institute provides education, biomedical research and hope for the many people throughout the world with cancer. Their new facility only increases their abilities to one day find a cure for the many types of cancer that exist.



TERASAKI LIFE SCIENCE BUILDING

CLIENT:
UCLA

REPRESENTATIVE OFFICE:
Toro-Aire

ABOUT THE PROJECT

The new UCLA Terasaki Life Sciences Building opened recently and ushered in a new chapter in the evolution of science education at the university. Consisting of two wings with open laboratories, offices, scholarly activity space, and building support spaces on five floors, the new new facility will be the foundation for the next phase of biomedical research. The 175,000 square-foot structure is supported by a cast-in-place concrete frame with flat-slab floor decks and is the new home of the Biological Sciences Department. Divisions within the department include Molecular Studies; Cell and Developmental Biology; Physiological Science; and Biology, Ecology and Evolution. The design team also built this lab building to attain LEED certification.

THE TITUS SOLUTION

Titus was able to provide many air distribution solutions for this project. The products were selected due to their ability



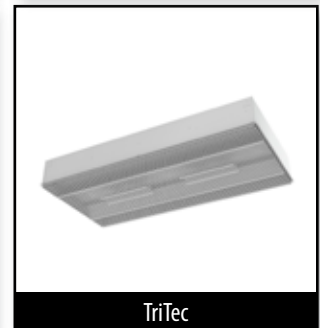
DESV



FlowBar



TLF



TriTec



ARCHITECT/DESIGNER:

Bohlin Gywinski Jackson/Stenfors Assoc. Architects

LOCATION:

Los Angeles, California

LEED CERTIFICATION:

LEED Certified

to provide superior performance while blending into the overall design of the building.

The new lab building utilizes a couple of Titus' best critical environment solutions - the TriTec and TLF diffusers. Titus TriTec diffusers are designed to meet the challenge of diluting airborne contaminants by supplying high-volume, low-velocity airflow to displace these impurities. The airflow pattern is designed to produce a uniform pattern to prevent dead spots where contaminants can linger. It is an excellent choice for Class 1,000 to 100,000 rooms. TLF diffusers can be used to create clean zones by positioning the diffuser directly over the area to be washed with clean air.

The Titus DESV is a digitally controlled single duct terminal unit that is unique as it incorporates many design features that increase performance, decrease service and installation costs, and offer increased value, over and above this basic function. The Titus FlowBar is an architectural linear diffuser that maximizes engineering

performance. It's outstanding performance allows higher airflows than conventional linear diffusers, with lower noise levels, making it ideal for high profile designs.

THE END RESULT

The new Terasaki Life Science Building fulfills a direct need that was lacking at the university. It provides a state-of-the-art facility for scientists, students and researchers to unwrap and discover more about the science of life. New innovations and potentially life altering secrets have the possibility of being unlocked now that key personnel have been given the tools needed.



critical environment diffusers



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www.titus-hvac.com | www.titus-energysolutions.com

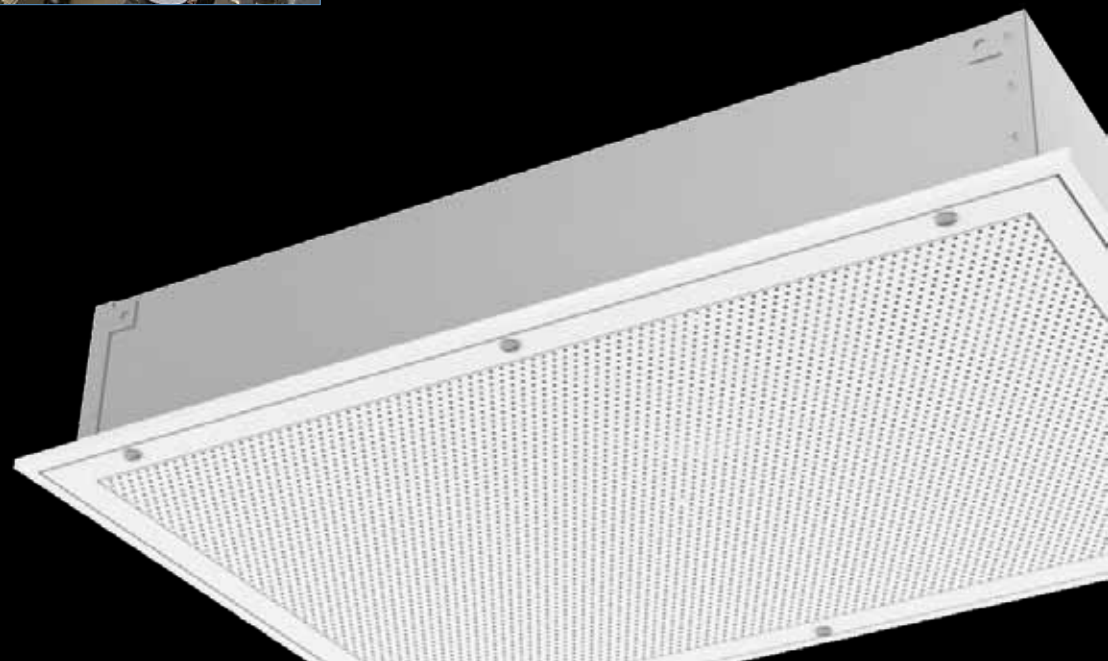


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RADIAL PATTERN



RadiaTec-AL / RadiaTec-SS

RADIAL PATTERN DIFFUSER

- Designed for cleanroom applications.
- Delivers high volumes of air at low velocity.
- Fixed radial discharge pattern with 1-way or 2-way option.
- Optional HEPA filter rack available .



TriTec / TriTec-AL / TriTec -SS

RADIAL PATTERN DIFFUSER

- Designed for cleanroom applications.
- Delivers high volumes of air at low velocity.
- Fixed radial discharge pattern with 1-way or 2-way option.



VersaTec / VersaTec-AL

RADIAL PATTERN DIFFUSER

- Designed for cleanroom applications.
- Delivers high volumes of air at low velocity.
- Radial discharge pattern is adjustable using face mounted louvers.

pages: R22-R25

LAMINAR PATTERN



TLF / TLF-AA / TLF-SS

LAMINAR PATTERN DIFFUSER

- Industry standard for unidirectional airflow diffuser.
- For use in clean air environments such as operating rooms.
- Laminar flow pattern minimizes induction and entrainment of room air.
- Steel, aluminum or stainless steel construction.
- Optional HEPA filter rack available.

Critical Environment Diffusers

pages: R26-R37



LineaTec-AL / LineaTec-SS

LINEAR AIR CURTAIN DIFFUSER

- For use in clean air environments like operating rooms.
- Creates air curtain barrier between clean zone and balance of room.
- Optional plenums available with square or round corners.
- Aluminum or stainless steel construction.



LINEAR AIR CURTAIN

SteriTec-AL / SteriTec-SS

STERILE ENVIRONMENT SYSTEM

- SteriTec system combines the TLF and LineaTec diffusers to form a clean zone within a clean room.
- Corner transitions are full plenum size creating no airflow restriction.
- Continuous plenums minimize duct runs.
- Aluminum or stainless steel construction.
- Optional HEPA filter rack available on TLF diffusers.

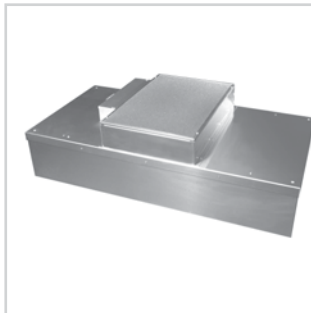
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FFD

FAN FILTER DIFFUSERS

- Unique solution for cleanroom environments.
- PSC motor.
- Solid state speed control.
- Low profile design.



FFDE

FAN FILTER DIFFUSERS

- Unique solution for cleanroom environments.
- ECM motor.
- Digital speed control.
- Low profile design.

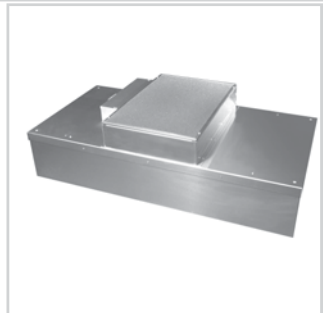
FAN FILTER DIFFUSERS



FFDER

FAN FILTER DIFFUSERS

- Unique solution for cleanroom environments.
- PSC motor.
- Solid state speed control.
- Roomside replaceable HEPA filter.
- Low profile design.



FFDR

FAN FILTER DIFFUSERS

- Unique solution for cleanroom environments.
- ECM motor.
- Digital speed control.
- Roomside replaceable HEPA filter.
- Low profile design.

Overview

APPLICATIONS

Titus representatives have installed diffusers in cleanrooms and in clean areas throughout the entire country for over 25 years. Many operating rooms and research laboratories as well as numerous other facilities have Titus environmental diffusers.

Clean rooms include hospital operating rooms, electronics manufacturing, pharmaceutical and biotechnology manufacturing, research facilities, automotive painting and many other applications.

GENERAL CLEANROOM INFORMATION

Design criteria for clean rooms include cleanliness classification desired, air volume requirements, air motion, proper filtration and removal of contaminants, properly designed equipment and personnel training. Titus products are designed to help the engineer with the proper air distribution requirements and air motion.

Critical Environment Diffusers

Contamination comes from two sources: external and internal. External sources include incoming air, wall penetrations for pipes, ducts and other HVAC equipment. Internal sources include personnel, process equipment, manufacturing processes and material ingress.

No matter what source has contributed to the unwanted particle count, the design of the clean room or clean area facilitates the control of incoming particles and eliminates particles within the environmental envelope.

AIR MOTION

Motion is critical to control concentrations of particles in the entire clean room or in a particular area of the room. Air motion is either unidirectional, also called laminar, or multi-directional. The following figure shows typical clean room airflow patterns. Unidirectional air motion is used to push unwanted particles out of the controlled space. Multi-directional air motion can be used to remove unwanted particles by dilution.



APPLICATIONS

When using multi-directional air motion the designer is depending solely on dilution to achieve the desired cleanliness level. Although dilution may reduce particle levels in the entire room to a moderate average level, it does not ensure that any given area in the room is controlled to acceptable particulate levels.

Laminar flow can be used to provide clean airflow over an obstruction and push particles to a floor return plenum. Return grilles can be located in the floor of the room and can be exhausted as shown in the figure, Laminar Flow. In many cases, however, codes require the return air grille to be mounted in the lower side-wall of the room. This allows the floors to be mopped and cleaned for standard conditions. For Class B and C operating rooms, the return grilles should be mounted with their lower frame at least 8 inches above the floor in the far corners of the room.

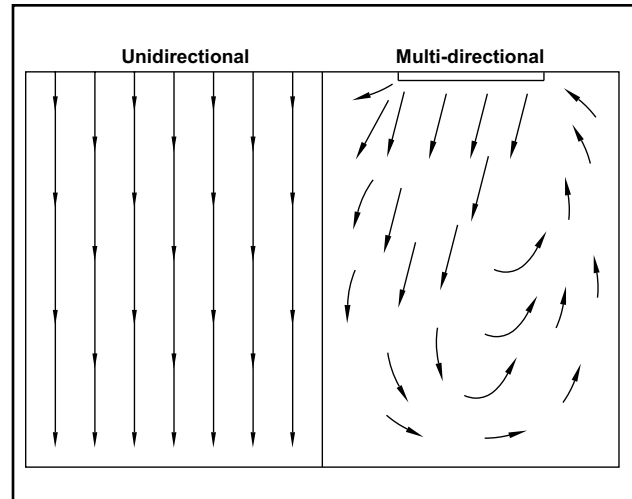
In many clean rooms work areas are designed with laminar flow. Fume hoods may obtain supply air from directly inside the room immediately adjacent to the fume hood while exhausting the air externally. The maximum allowable air velocity in front of fume hoods must be less than the capture velocity of the hood. This room velocity is generally about 15 to 35 fpm, helping to ensure the air within the fume hood is not induced out of the hood and into the room. Proper location of air devices helps further reduce unwanted air motion. The placement of the diffuser can be critical and care should be taken to avoid entrainment of fumes from hoods into the laboratory. Special short throw diffusers can be used in these locations to eliminate high velocities from moving across the face of the hoods as shown in the photograph in the preceding page. Typical hood capture velocities are about 100 fpm.

Whether unidirectional or multi-directional airflow patterns are utilized, air velocities in the clean area must be controlled. Particles 0.5 micrometers and larger tend to quickly settle on the floor or other work surfaces due to gravity. These particles are easily disturbed and re-entrained into the clean room atmosphere, thereby recontaminating a previously clean area. To control re-entrainment, air velocities at the floor area should be below 50 fpm.

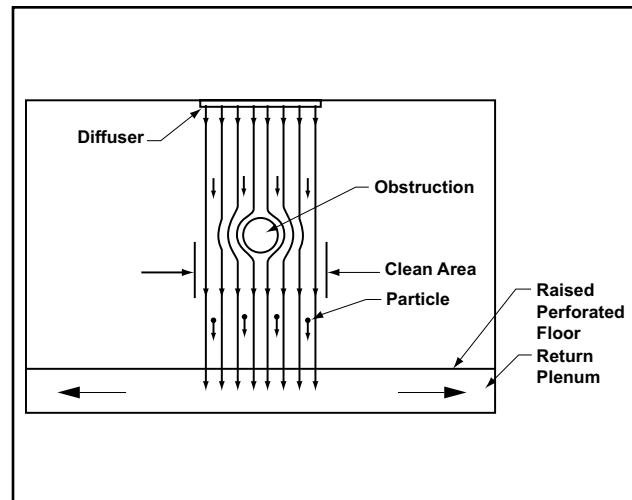
AIR VOLUME

Air volume is a key to creating and sustaining any given class of a clean room. Large volumes of clean air are used to dilute contaminated air. In other words, contaminated air is slowly displaced by clean, treated air. As more clean air is brought into the room and contaminated air is removed from the room, the clean air dilutes the contaminated air. This process slowly reduces the particle level in the room. Volume is determined by the job engineer according to standard industry practices, experience, and situational requirements. It is common to specify 10 to 40 air changes per hour in a critical environment. Class 1 to 100 clean rooms may have air change rates as high as 300 to 600 air changes per hour.

Critical Environment Diffusers



Typical Airflow Patterns in Clean Room



Laminar Flow (Class 1 - 1000)

Filter Designation and Efficiency Level

Name	Designation	Efficiency	Max Particle Size
High-Efficiency Filter	HE	95%	0.3μ
High-Efficiency Particulate Filter	HEPA	99.90%	0.3μ
Ultra-Low Penetration Air Filter	ULPA	99.9995%	0.12μ

AIR FILTRATION AND QUALITY CONTROL

All clean rooms utilize filtration systems to purify incoming air and/or recirculated air. These systems usually include prefilters that are low cost and easily replaceable. Prefilters are the first step in extracting or trapping unwanted particles from the air.

Upstream of the high-efficiency particulate (HEPA) or ultra-low penetration (ULPA) air filters, prefilters of 30 percent and then 85 percent greatly reduce the amount of contaminants that need to be eliminated by HEPA or ULPA filters. The chart on this page classifies commonly designated filters and their efficiencies.

For clean room classes 1,000 to 100,000, regardless of the filter classification specified, several principles should be considered prior to application. The best place for high-efficiency filters is upstream of the air outlets in a remote location. If the high-efficiency filter is an integral part of the air distribution device, removal of the filter should be accomplished from outside the protected zone. Working with the filter in the protected zone creates a high probability of contaminating the clean zone.

Volume control dampers should be located upstream of the high-efficiency filter so that operation of the damper does not contaminate the airstream.

Chemical filtration may also be included. The filter media is typically activated carbon.

Air quality includes temperature and humidity control. Elaborate systems have been developed by the industry to control these two factors. Humidity is typically controlled somewhere around 50%. Temperature control specifications may be within 1° F or less.

Pressurization of the clean room or clean zone also contributes to air quality. Higher pressure clean zones help reduce infiltration of contaminants from outside

sources. The typical room differential pressure specified is 0.05 inch wg according to Federal Standard 209B. Most critical environmental rooms have positive pressurization to keep contamination out of these areas.

PROPER EQUIPMENT

Equipment and construction materials may emit contamination. Equipment utilized in clean rooms is typically 304 stainless steel. Internal construction is engineered to retard outflow of contaminants from sources such as bearings, plastics and other decaying material or moving parts.

Air showers or tunnels may be provided for personnel entering the controlled zone. Air curtains may be used to also protect the clean zone.

Cleaning equipment such as high efficiency vacuum cleaners, tack cloths, lint-free cleaning cloths and autoclaves all contribute to the overall cleanliness of the room or area.

PERSONNEL TRAINING

Proper clean room etiquette is critical to maintaining a clean environment. Protocol for entering the room and leaving the room must be maintained. Movement within the room must be controlled. Sudden movements by personnel can entrain settled contaminated particles back into the clean airstream.

Titus has a complete line of diffusers designed for applications requiring unidirectional or multi-directional airflow. Laboratories, operating rooms, electronics manufacturing, pharmaceutical and biotechnology manufacturing, automotive painting and many other applications can benefit from using Titus Critical Environment Diffusers.

Radial Pattern

VersaTec

HEMISPHERICAL AIR DIFFUSION USING ADJUSTABLE BLADES

Available Models:

- VersaTec
 - Steel Backpan with Aluminum Blades.
- VersaTec-AL
 - Aluminum Backpan and Blades.

Finish

- Standard Finish - #26 White
- Optional Finish - #04 Mill
- Uses specially formed adjustable blades for maximum free area and directional throw.
- High airflow capacity (200 to 1,000 cfm).
- Available in 24 x 24-inch or 48 x 24-inch module sizes.
- Individually adjustable louvers.
- Backpan not visible from below.
- Louvers direct airflow slightly below ceiling level.



VersaTec

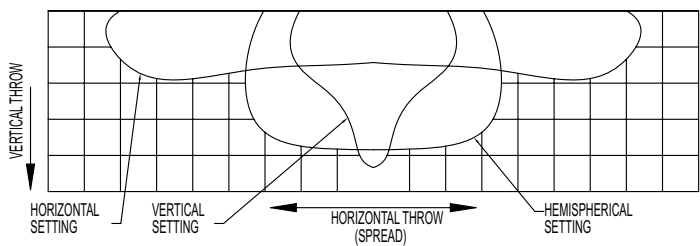
- 24 x 24-inch has 10-inch inlet
48 x 24-inch has 12-inch inlet.
- Perforated or louvered center section.
- Available for laying into standard T-bar ceiling grids. Surface mounted units are laid into a Titus TRM frame.
- Internal air baffling to equalize airflow across the face of the diffuser.

OVERVIEW

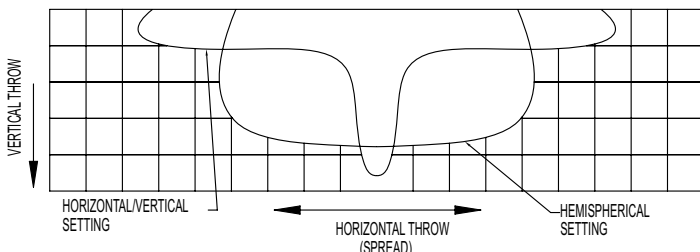
VersaTec models feature adjustable pattern control technology for delivering high volumes of low velocity air in a radial pattern. Each model is constructed using adjustable blades which allow adjustment of the discharge air pattern. Two versions of this model are available; VersaTec with an optional adjustable blade face and VersaTec with a perforated center section. VersaTec diffuser blades hang less than 1-inch below the ceiling.

These diffusers are an excellent choice for Class 1,000 to 100,000 rooms. Applications include clean room environments such as labs with exhaust hoods, pharmaceutical manufacturing and biotechnology research.

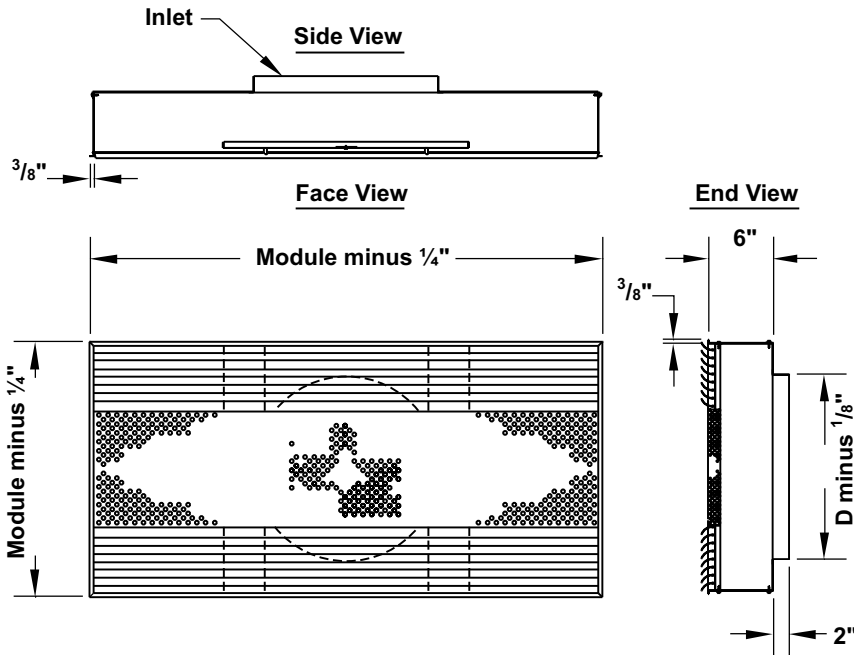
VersaTec with adjustable blade face



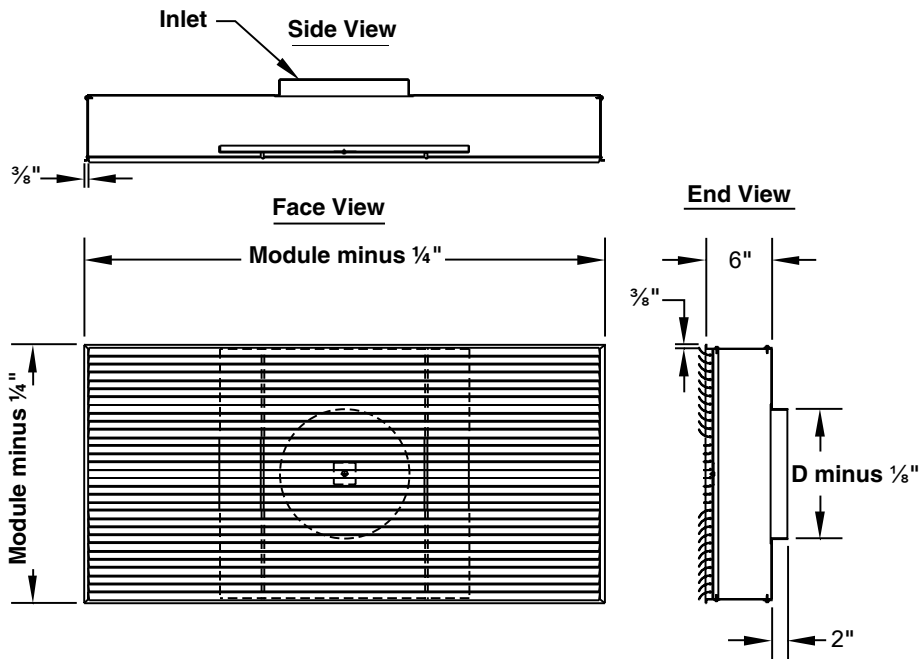
VersaTec with perforated center section



VersaTec with perforated center section



VersaTec with optional adjustable blade face



VERSATEC AND VERSATEC-AL

		Discharge Pattern						
		Hemispherical			Horizontal (Spread)			
		400	600	800	400	600	800	
48" x 24" 12" Inlet	cfm	400	600	800	400	600	800	
	NC	23	28	30	26	31	33	
	Total Pressure	0.05	0.10	0.18	0.05	0.13	0.24	
	5° F _Δ T	Horizontal Throw	1-2-4	2-3-6	3-4-7	3-4-7	5-6-8	5-6-13
		Vertical Throw	1-2-3	2-3-5	2-4-7	1-3-4	2-3-6	3-4-7
	15° F _Δ T	Horizontal Throw	1-2-3	2-3-5	3-3-6	3-4-5	4-5-6	5-5-11
		Vertical Throw	1-3-5	2-4-7	2-4-8	1-3-6	2-4-8	3-5-9
24" x 24" 10" Inlet	cfm	200	300	400	200	300	400	
	NC	21	25	27	22	27	29	
	Total Pressure	0.02	0.07	0.14	0.04	0.09	0.16	
	5° F _Δ T	Horizontal Throw	1-1-1	1-1-2	1-2-3	2-4-6	4-5-9	5-7-12
		Vertical Throw	1-1-2	1-2-4	2-3-5	2-3-6	3-5-7	4-6-9
	15° F _Δ T	Horizontal Throw	1-1-1	1-1-2	1-1-2	2-3-5	2-4-8	5-6-10
		Vertical Throw	1-1-3	1-2-5	2-4-6	2-3-8	3-5-8	4-7-10

- Throws are to terminal velocities of 100, 50 and 25 fpm. See the section, Engineering Guidelines and the topic Procedure to Obtain Catalog Throw Data in this catalog for throw information.
- The horizontal throw is the distance of the overall width of the jet.
- Use above performance data table for optional curved blade center section.
- NC is the noise criteria curve that will not be exceeded in octave bands 2 thru 7. The NC assumes a 10 db room absorption.
- Air patterns between the two shown in the isovel diagrams on the previous page can be obtained by adjustment of the blades.



SUGGESTED SPECIFICATIONS

VERSATEC, VERSATEC-AL

Air diffusers marked _____ shall be Titus model number VersaTec, VersaTec-AL. Diffusers shall be constructed using a maximum 6 inches tall backpan designed for optimum performance with the diffuser.

The backpan shall be provided with cross sectionalizing baffles to evenly distribute supply air. The diffuser face shall have adjustable longitudinal extruded aluminum blades for directional air control. The face shall hang below ceiling level no more than 1¼ inches when the blades are in the full open position. Blades shall be divided into three sets: right-hand, left-hand and vertical projection.

The air pattern must be adjustable from a radial pattern to a horizontal, vertical, or a combination of both horizontal and vertical. Diffuser shall be available with optional 51 percent free area perforated center section.

Critical Environment Diffusers

PERFORMANCE

NC values representing the noise criteria curve shall be published. Throw values for terminal velocities of 100, 50 and 25 fpm shall be published along with corresponding pressure drop.

Throws shall be published for both horizontal and vertical air patterns. Performance tests shall have been conducted in accordance with ASHRAE Standard 70-2006 and ASHRAE Standard 113-2009.

MODEL NUMBER SPECIFICATION

Model		Module Size		Rapid Mount Frame	Optional	White (std.) Mill	Finish
VersaTec-AL VersaTec		24 x 24 48 x 24			TRM		26 04
XXXXXXXX-XX	XX	XX x XX	X		XX	XX	XX
Inlet Size		Blow Pattern			Face Style		
48 x 24 Module 12"	12	2-Way		2	Perforated Center	P	
24 x 24 Module 10"	10				Straight Blade	S	

TriTec

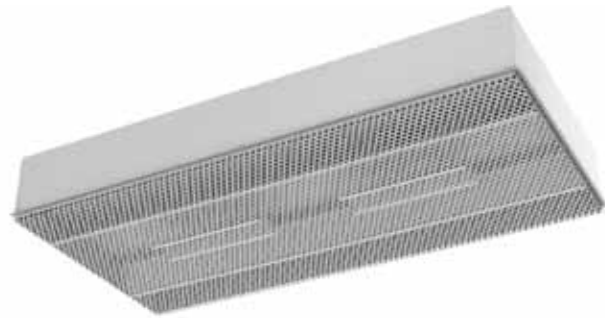
HIGH VOLUME, LOW VELOCITY, RADIAL AIR DIFFUSION TECHNOLOGY

Available Models:

- TriTec • Steel Face and Back Pan
- TriTec-AL • 304 Stainless Steel Face with Aluminum Back Pan.
- TriTec-SS • 304 Stainless Steel Face and Back Pan.

Finish

- Standard Finish - #26 White
- Optional Finish - #04 Mill
- Face drops no more than 5/8-inch below the ceiling.
- Removable face for sanitizing (no special tool required to remove the face).
- Available in steel, 304 stainless steel, or aluminum with 304 stainless steel face.
- Available in 24 x 24-inch and 48 x 24-inch module sizes.



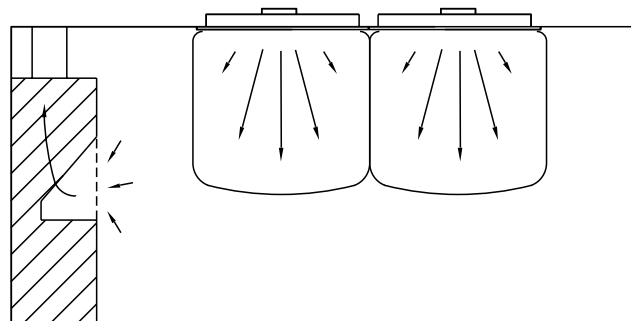
TriTec

- Low velocity hemispherical pattern or one-way hemispherical pattern available.
- Factory supplied back pan with every unit.
- 22-gauge backpan.
- Available in inlet sizes of 8 or 10 inches for 24 x 24-inch module sizes, 10 or 12 inches for 24 x 48-inch module sizes.
- Standard unit lays into standard T-bar ceiling grids. Optional TRM mounting frame available for surface mounting.
- Simple to install and maintain.
- Great for use in fume hood areas.
- Earthquake tabs supplied as standard.
- Retainer cable supplied with every unit.
- 51 percent free area perforated face matches industry standard perforated diffuser's appearance.

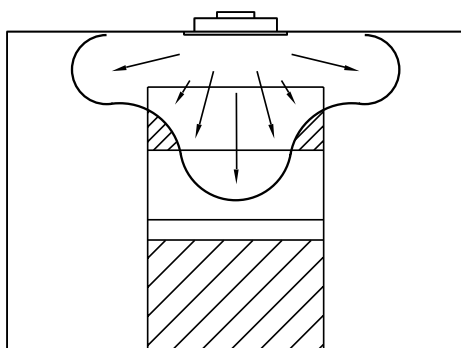
Chemistry Lab with TriTec Diffusers



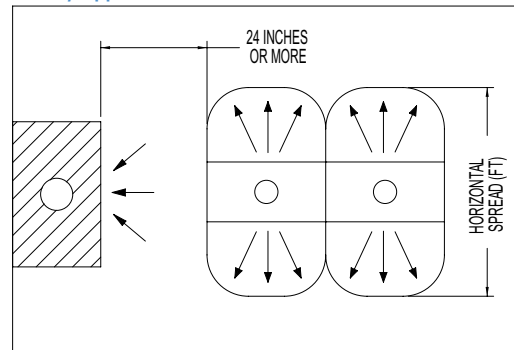
TriTec Laboratory Application - Side View



TriTec Laboratory Application - End View



TriTec Laboratory Application - Plan View



DIMENSIONS

OVERVIEW

TriTec models are designed to allow large volumes of air to be brought into the environment with very short throws.

Discharging air flow patterns of a two-way blow provide a 180 degree radial pattern, TriTec takes advantage of the maximum space available for distributing velocity. This results in the lowest possible velocities for the volume of air being delivered. Unlike competitive models, TriTec takes advantage of a 51 percent free area perforated face that hangs below the ceiling less than $\frac{5}{8}$ -inch. In appearance, TriTec models look like industry standard perforated diffusers.

TriTec's unique design allows it to create a full pattern in the middle of the diffuser as well as on the ends. The design of the TriTec allows these diffusers to be mounted end to end without increasing the throw.

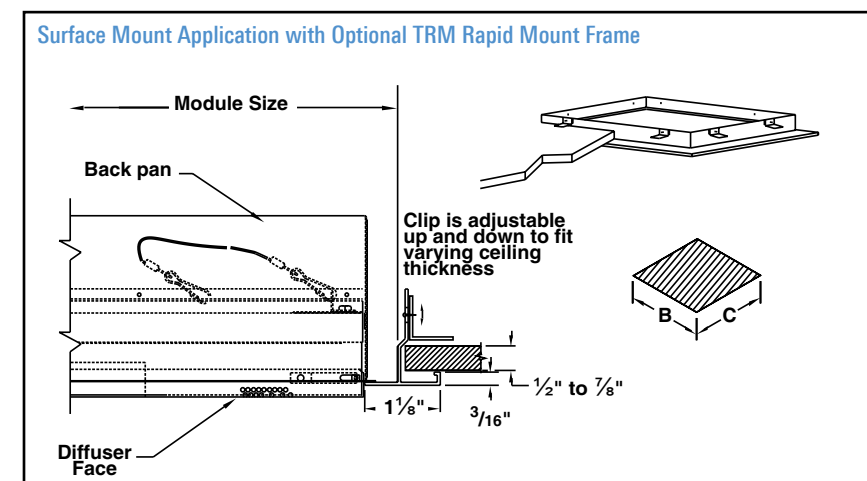
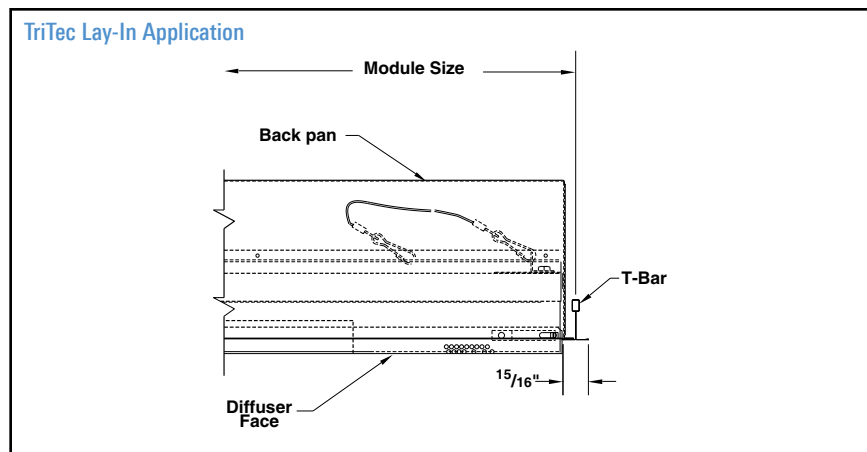
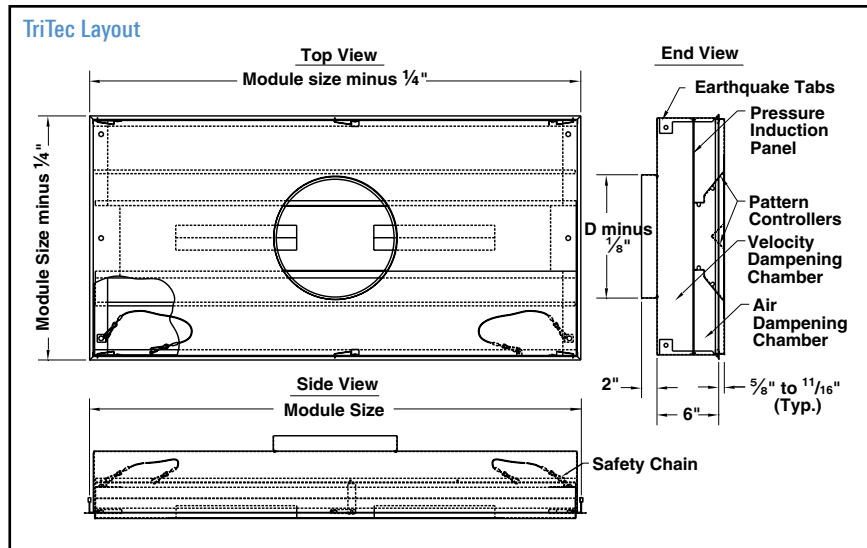
Applications include labs with exhaust hoods, pharmaceutical manufacturing, telephone switching rooms, biotechnology research and many other applications where high airflows with short throws are required. This diffuser has a very high induction rate. These diffusers are an excellent choice for Classes 1,000 to 100,000 rooms.

High induction diffusers, like the TriTec should not be specified for Class B or C operating rooms.

DIMENSIONS

Air enters the diffuser and is spread across the entire diffuser by the pressure induction plate. As air passes through the pressure induction plate it expands into the air dampening chamber. While passing through the air dampening chamber, long fixed blades direct the air creating a hemispherical air pattern as the air passes through the 51 percent free area face.

Critical Environment Diffusers



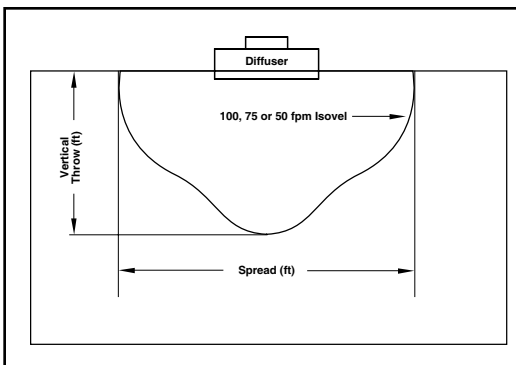
TRITEC, TRITEC-AL AND TRITEC-SS

Module Size and Inlet Size	2-Way Pattern				Horizontal Spread (ft)			Vertical Throw (ft)								
								5 Deg ΔT			10 Deg ΔT			15 Deg ΔT		
	cfm	Ps	Pt	Nc	100-75-50			100-75-50			100-75-50			100-75-50		
24" X 24" 8" Inlet	250	0.055	0.087	25	1	2	5	1	2	3	1	2	3	1	2	4
	300	0.080	0.126	29	2	3	6	1	3	4	1	2	4	2	3	5
	400	0.142	0.224	37	3	5	7	3	3	5	2	4	5	3	5	7
	500	0.222	0.350	42	5	6	8	3	4	5	3	5	7	4	6	8
24" X 24" 10" Inlet	250	0.026	0.039	<20	1	1	3	0	1	2	0	1	2	1	1	2
	300	0.037	0.056	20	1	2	4	1	1	2	1	1	3	1	1	3
	475	0.093	0.140	31	3	5	7	1	3	6	2	3	6	2	4	7
	600	0.148	0.224	37	4	6	9	2	4	8	3	5	8	3	6	9
24" X 48" 10" Inlet	375	0.054	0.084	<20	3	4	6	0	1	1	1	1	2	1	1	2
	500	0.097	0.149	26	4	6	9	1	1	3	1	2	4	1	2	4
	700	0.190	0.292	39	6	8	10	1	2	5	2	4	6	2	4	7
	900	0.313	0.483	48	8	10	12	2	4	7	3	5	8	3	6	9
24" X 48" 12" Inlet	500	0.054	0.080	20	1	2	4	1	1	2	1	1	3	1	2	4
	650	0.092	0.135	24	2	3	7	1	2	4	1	2	5	2	3	6
	750	0.122	0.179	34	2	4	9	1	2	5	2	3	6	2	4	7
	1000	0.218	0.319	44	4	7	11	2	4	6	3	5	8	4	6	9
Module Size and Inlet Size	1-Way Pattern				Horizontal Spread (ft)			Vertical Throw (ft)								
								5 Deg ΔT			10 Deg ΔT			15 Deg ΔT		
	cfm	Ps	Pt	NC	100-75-50			100-75-50			100-75-50			100-75-50		
24" X 24" 8" Inlet	250	0.055	0.087	<20	1	2	3	0	0	1	1	1	2	1	1	3
	325	0.094	0.148	29	2	3	4	0	1	2	1	2	4	1	2	5
	400	0.142	0.224	35	3	3	4	1	1	3	2	3	6	2	4	8
	450	0.179	0.283	38	3	4	4	1	1	3	2	3	9	3	5	9
24" X 24" 10" Inlet	250	0.025	0.038	<20	1	2	4	1	1	3	1	1	3	2	3	7
	350	0.049	0.075	22	3	4	6	1	2	5	2	3	6	4	6	9
	450	0.081	0.123	28	4	5	7	2	4	6	3	5	7	6	8	9
	550	0.121	0.184	34	4	6	8	3	5	7	4	6	9	7	9	9
24" X 48" 10" Inlet	500	0.092	0.144	24	1	2	3	1	2	4	1	2	4	3	6	9
	625	0.143	0.225	32	2	2	4	2	3	5	2	3	6	5	8	9
	750	0.206	0.324	39	2	3	4	2	4	6	2	4	7	7	9	9
	900	0.297	0.467	44	3	4	6	4	5	8	4	7	9	8	9	9
24" X 48" 12" Inlet	500	0.051	0.076	<20	1	2	3	2	4	7	4	6	8	4	6	8
	650	0.086	0.129	25	2	3	4	4	6	9	6	7	9	6	7	9
	750	0.114	0.171	31	3	3	5	5	7	9	6	8	9	6	8	9
	1000	0.203	0.304	42	3	5	7	7	9	9	8	9	9	8	9	9

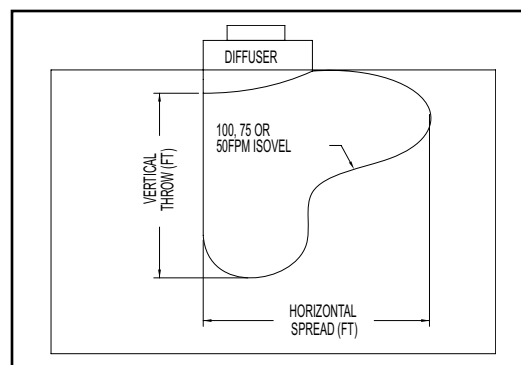
- Spread is the maximum width of the isovel at the indicated terminal velocity.
- Vertical throw is the furthest distance below the ceiling where the indicated terminal velocity can be measured.
- Tests were conducted in a 16 x 16-foot room, with a 9-foot ceiling, low side wall returns, in accordance with ASHRAE Standard 113-2009, in several planes.

- Low emissivity heaters were used to maintain loads, and were set to match the supply air conditions. The room was free of obstructions during the tests.
- Sound and pressure drop tests were conducted in accordance with ASHRAE Standard 70-2006 and ANSI S1.31 Procedures.

2-WAY PATTERN



1-WAY PATTERN



SUGGESTED SPECIFICATIONS

TRITEC

Air diffusers marked _____ shall be Titus model number TriTec. Diffusers shall be constructed using a maximum 6 inches tall backpan designed for optimum performance with the diffuser. The backpan shall be divided into two chambers: upper and lower. The backpan shall have integral hanger tabs for securing the unit to the overhead structure. The upper velocity dampening chamber shall be separated from the lower air dampening chamber by a pressure induction plate. All pattern controllers shall be internal to the unit and shall be located in the lower air dampening chamber.

The face of the diffuser shall be 51 percent free area perforated steel with $\frac{3}{16}$ -inch diameter holes on $\frac{1}{4}$ -inch staggered centers, and shall match the appearance of industry standard perforated diffusers. The face shall not hang below the ceiling more than $\frac{5}{8}$ inches and shall have 6 clips securing it in place.

The diffuser face shall have factory attached retainer cables. The cables shall have removable clips to allow field cleaning of all diffuser components.

Quarter-turn fasteners on the face are not acceptable. The face, lower air chamber, directional blades, and the pressure induction plate shall be one assembly that can be removed from the face of the unit for sanitizing in an autoclave. The face shall be provided with two retainer cables.

The backpan shall be manufactured of 22-gauge steel. The diffuser must be available for full radial air diffusion (two-way) and/or $\frac{1}{2}$ radial air diffusion (one-way).

Critical Environment Diffusers

PERFORMANCE

NC values shall be published. Throw for terminal velocities of 100, 75 and 50 fpm shall be published along with corresponding pressure drop. See the section, Engineering Guidelines and the topic 'Procedure to Obtain Catalog Throw Data' for additional throw data.

Performance tests shall have been conducted in ASHRAE Standard 70-2006 and ASHRAE Standard 113-2009.

TRITEC-AL

Use TriTec specification and make the following changes:

- Change the model number to TriTec-AL.
- Change the reference of steel to aluminum for the backpan.
- Change the reference of steel to 304 stainless steel for the face.

TRITEC-SS

Use TriTec specification and make the following changes:

- Change the model number to TriTec-SS.
- Change all reference of steel to 304 stainless steel.

MODEL NUMBER SPECIFICATION

Model		Module Size		Finish		
TriTec		24 x 48		White (std.)	26	
TriTec-AL		24 x 24		Mill	4	
TriTec-SS		XXxXX	X	XX		TRM
XXXXXX-XX	XX					
Inlet Size		Blow Pattern		Optional		
(note)	8"	1-Way	1	Rapid Mount		
	10"	2-Way	2	Frame		
	12"					

Note: 8 and 10-inch inlets available with 24 x 24 module; 10 and 12-inch inlets available with 24 x 48 module.

RadiaTec

HIGH VOLUME LOW VELOCITY RADIAL AIR DIFFUSION TECHNOLOGY

Available Models:

- RadiaTec-AL • Aluminum Face and Backpan.
- RadiaTec-SS • 304 Stainless Steel Face and Backpan.

Finish

- Standard Finish - #26 White
- Optional Finish - #04 Mill
- Removable face for sanitizing from room-side (no special tool required).
- Available in aluminum and 304 stainless steel modular parts, (face and back pan can be of a different material).
- Available in 24 x 24-inch and 48 x 24-inch module sizes with one-way or two-way patterns.
- Available inlet sizes: 8 or 10 inches for 24 x 24-inch; 10 or 12 inches for 48 x 24-inch modules.



RadiaTec

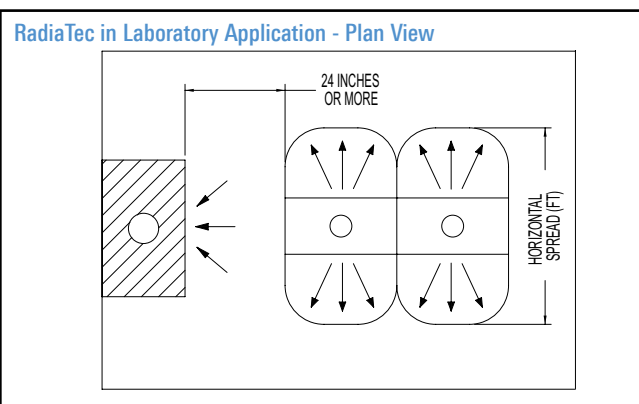
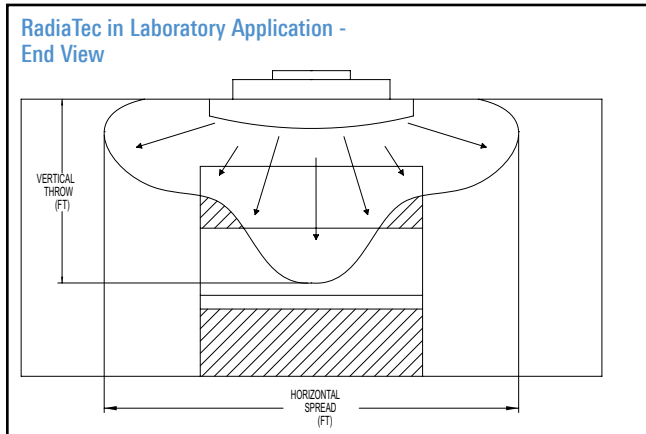
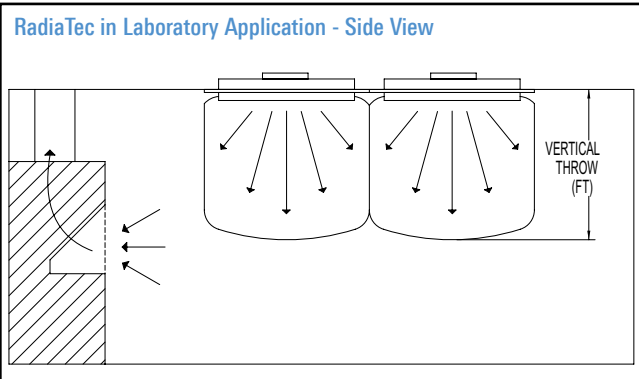
- Compatible with 1 or 1½-inch T-bar ceiling grids. Optional TRM mounting frame available for surface mounting.
- Optional HEPA Filter rack available. (filter by Titus or others)
- Unique baffling inside diffuser assures even air distribution across entire face.
- Quarter-turn fasteners and retainer cables allow easy access for cleaning and filter replacement.

OVERVIEW

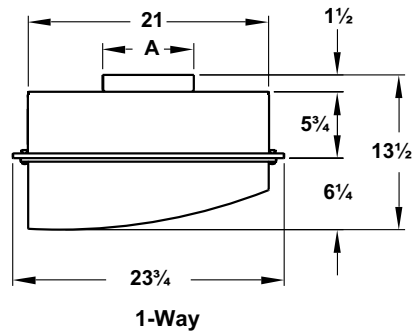
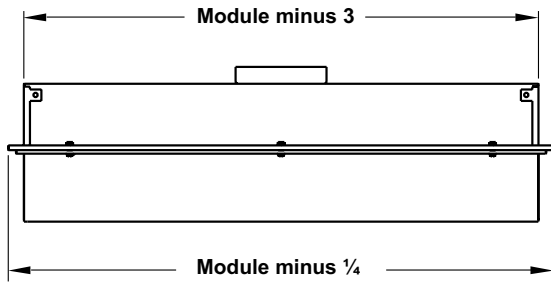
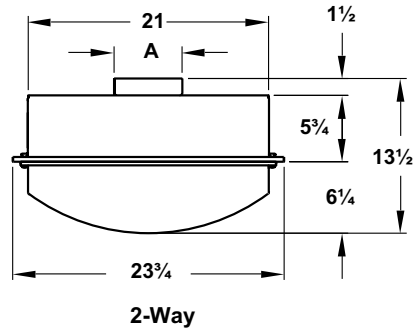
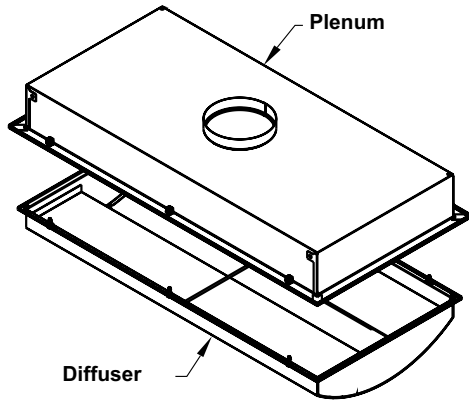
The RadiaTec diffuser is designed to meet the challenge of diluting airborne contaminants by supplying high-volume, low-velocity airflow to displace these impurities. The airflow pattern is designed to produce a uniform pattern to prevent dead spots where contaminants can linger. In addition, the air pattern is tighter to the ceiling than competitor models to limit the air pattern penetration into the habitable zone.

The RadiaTec creates a full pattern along the face of the diffuser, and when mounted end-to-end, throw is not increased.

Applications include labs with exhaust fans, pharmaceutical manufacturing, biotechnology and other applications where high air volume with short flow are required. The RadiaTec's high induction rate draws impurities into its airstream, allowing it to be diluted to less harmful levels prior to exhausting the air. Excellent choice for Class 1,000 to 100,000 rooms.

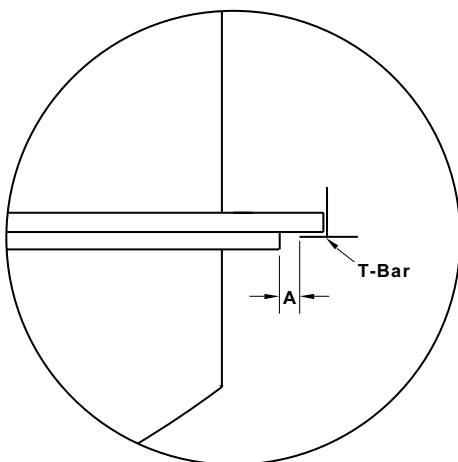


Standard Model, No HEPA Filter Rack



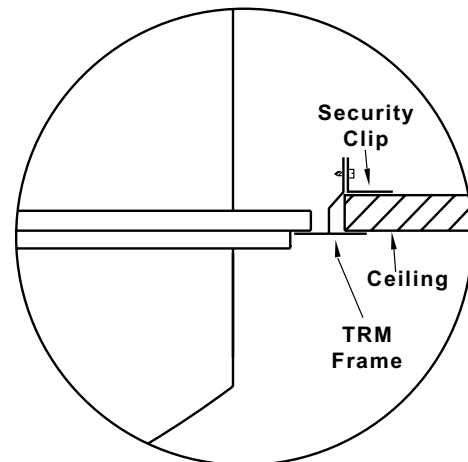
Module Size	Nominal Inlet Size	A
24 x 24	8	7 ⁷ / ₈
	10	9 ⁷ / ₈
48 x 24	10	9 ⁷ / ₈
	12	11 ⁷ / ₈

Border Detail Lay-in

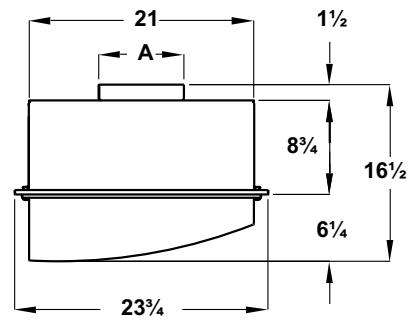
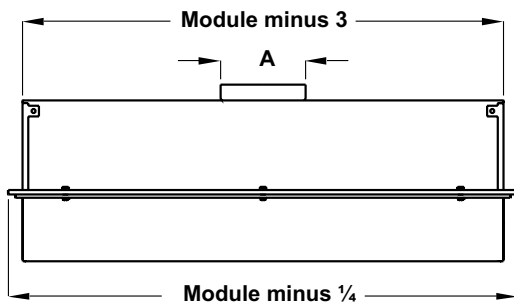
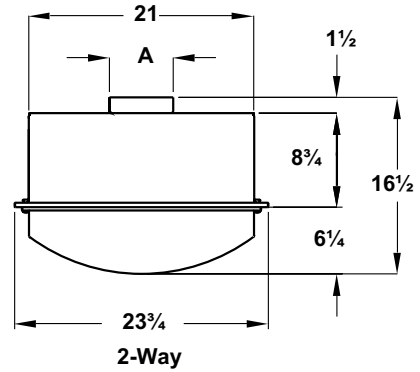
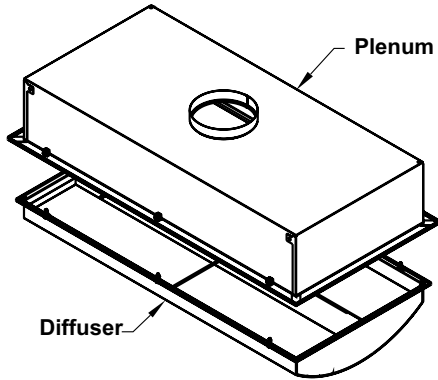


Tee	A
1"	3 ³ / ₈
1 1/2"	1 ¹ / ₈ "

Surface Mounting with TRM frame

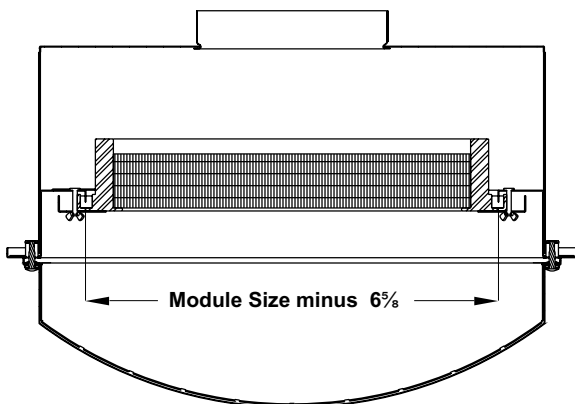


HEPA Filter Rack Model

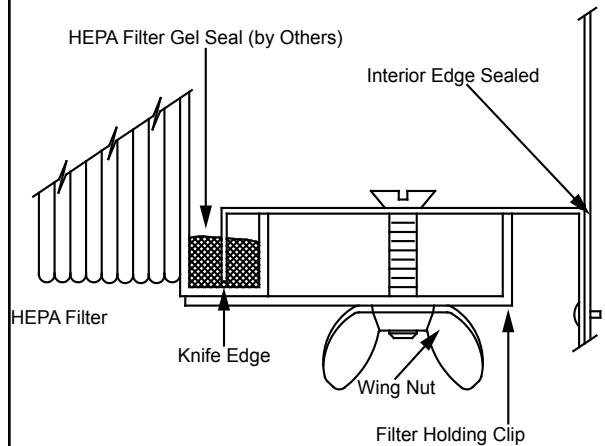


Module Size	Nominal Inlet Size	A
24 x 24	8	7 ⁷ / ₈
	10	9 ⁷ / ₈
48 x 24	10	9 ⁷ / ₈
	12	11 ⁷ / ₈

HEPA Filter Rack Knife Edge Dimensions



HEPA Filter Rack



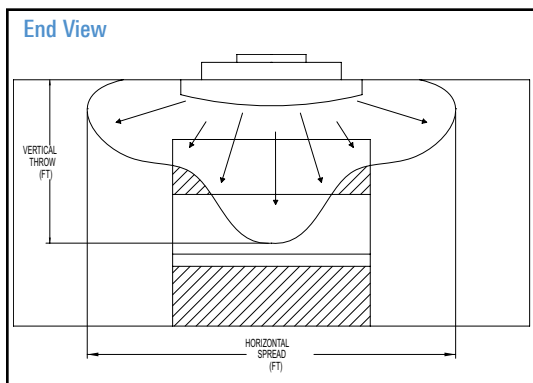
RADIATEC-AL AND RADIATEC-SS

www.titus-hvac.com | www.titus-energy.com

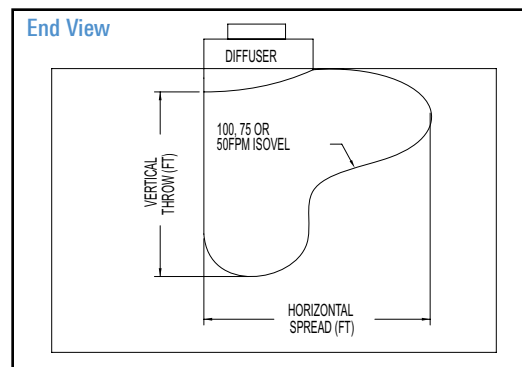
Module Size Inlet Size	2-Way Pattern				Horizontal Spread (feet)						Vertical Throw (feet)					
					5 Degree ΔT			15 Degree ΔT			5 Degree ΔT			15 Degree ΔT		
	cfm	Ps	Pt	NC	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50		
24" x 24" 8" Inlet	200	0.082	0.061	-	5	6	8	4	5	7	2	3	3	2	3	4
	300	0.092	0.138	18	7	8	9	6	7	8	2	4	5	2	4	6
	400	0.163	0.245	28	8	9	10	7	8	10	4	5	6	4	5	7
24" x 24" 10" Inlet	300	0.075	0.094	18	6	7	8	6	6	7	3	4	5	3	4	5
	400	0.133	0.167	28	6	7	9	6	7	8	4	5	6	4	5	6
	500	0.209	0.261	35	7	8	10	7	8	9	4	5	6	5	6	7
48" x 24" 10" Inlet	400	0.027	0.061	-	2	3	5	2	3	5	1	2	3	2	3	4
	600	0.062	0.138	15	4	5	6	4	5	6	1	2	4	3	4	6
	800	0.111	0.245	23	5	6	7	5	6	7	1	2	4	4	5	7
48" x 24" 12" Inlet	600	0.065	0.101	-	4	5	7	3	5	6	2	3	4	3	4	5
	800	0.114	0.179	20	5	6	8	4	5	7	3	4	5	4	5	6
	1000	0.179	0.280	27	6	7	9	5	6	8	3	4	6	4	5	7
Module Size Inlet Size	1-Way Pattern				Horizontal Spread (feet)						Vertical Throw (feet)					
					5 Degree ΔT			15 Degree ΔT			5 Degree ΔT			15 Degree ΔT		
	cfm	Ps	Pt	NC	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50	100 - 75 - 50		
24" x 24" 8" Inlet	200	0.053	0.071	12	5	6	7	5	6	7	1	2	3	1	2	3
	300	0.118	0.164	25	6	7	8	6	7	9	2	4	6	2	4	6
	400	0.209	0.291	34	7	8	9	7	8	10	4	5	7	3	5	7
24" x 24" 10" Inlet	300	0.111	0.130	26	5	6	7	5	6	8	4	5	6	6	7	9
	400	0.196	0.230	35	6	7	8	6	7	9	5	6	7	7	8	10
	500	0.308	0.360	41	7	8	10	7	8	10	6	7	8	8	9	11
48" x 24" 10" Inlet	400	0.029	0.063	-	3	5	7	3	5	8	3	4	6	4	6	8
	600	0.066	0.142	16	5	6	8	6	7	9	5	6	7	6	7	8
	800	0.119	0.253	26	7	8	9	7	8	10	5	6	8	7	8	10
48" x 24" 12" Inlet	600	0.075	0.111	-	4	6	8	5	6	7	4	5	6	6	6	7
	800	0.133	0.198	23	7	8	9	6	7	8	5	6	7	7	8	10
	1000	0.208	0.309	31	8	9	11	7	8	9	5	6	7	8	9	11

- Spread is the maximum width of the isovel at the indicated terminal velocity.
- Horizontal throw is the furthest distance from diffuser center point where the indicated terminal velocity can be measured.
- Vertical throw is the furthest distance below the ceiling where the indicated terminal velocity can be measured.
- Low emissivity heaters were used to maintain loads, which were set to match the supply air conditions. There were no obstructions in the room during the tests.
- Sound and pressure drop tests were conducted in accordance with ASHRAE Standard 70-2006 and ANSI S1.31 Procedures.

2-WAY PATTERN



1-WAY PATTERN



SUGGESTED SPECIFICATIONS

RADIATEC

Air diffusers marked _____ shall be Titus model number RadiaTec-AL. Diffusers shall be constructed using a maximum 4 inches tall back pan (standard models) or 6-inch back pan (HEPA filter models) designed for optimum performance of the diffuser. The back pan shall be divided into two chambers connected via a baffle aperture designed to evenly distribute air across the diffuser's perforated face. The back pan shall have integral hanger tabs for securing the unit to the overhead structure. The baffles forming the aperture will be located within the lower air chamber. The face of the diffuser shall be constructed of 13 percent free area perforated aluminum or 1/4-inch stagger centers.

The interior of the diffuser shall be accessible for sanitization and filter replacement from below (room-side) by loosening the quarter-turn fasteners to allow the face to swing open, and can be disengaged by releasing the retainer cables attaching the face to the diffuser frame. The diffuser must be available for full radial air diffusion (two-way) or one-half radial air diffusion (one-way). The face and back pan will be constructed of aluminum, but will be modular to allow the face or back pan to be constructed of stainless steel, if required. Options include HEPA filter rack and foam gasketing.

MODEL NUMBER SPECIFICATION

Model	Module Size (Note1)		Discharge Pattern	HEPA Filter Rack	Accessories (Note 2)
RadiaTec-AL		24 x 24	1-Way		H
RadiaTec-SS		48 x 24	2-Way		FG
XXXXXXXX-XX	XX	XX x XX	X	XX	XX
Inlet Size			Finish		
8"	8		White (std. for RadiaTec-AL)	26	
10"	10		Mill (std. for RadiaTec-SS)	04	
12"	12				

Note 1: 8 and 10-inch inlets available with 24 x 24 module; 10 and 12-inch inlets available with 48 x 24 module.
 Note 2: Foam Gasketing is standard with HEPA Filter Rack option. Filter by Titus or others.

Critical Environment Diffusers

PERFORMANCE

NC values shall be published. Throw for terminal velocities of 100, 75 and 50 fpm shall be published along with corresponding pressure drop. See the section, Engineering Guidelines and the topic 'Procedure to Obtain Catalog Throw Data' for additional throw information. Performance tests shall have been conducted in ASHRAE Standard 70-2006 and ASHRAE Standard 113-2009.

RADIATEC-SS

Use RadiaTec specification and make the following changes:

- Change the model number to RadiaTec-SS.
- Change all reference of aluminum to 304 Stainless Steel.

Laminar Pattern

Critical Environment Diffusers

TLF

VERTICAL LAMINAR FLOW TECHNOLOGY

Available Models:

- | | |
|--------|----------------------|
| TLF | •Steel |
| TLF-AA | •Aluminum |
| TLF-SS | •304 Stainless Steel |

Finish

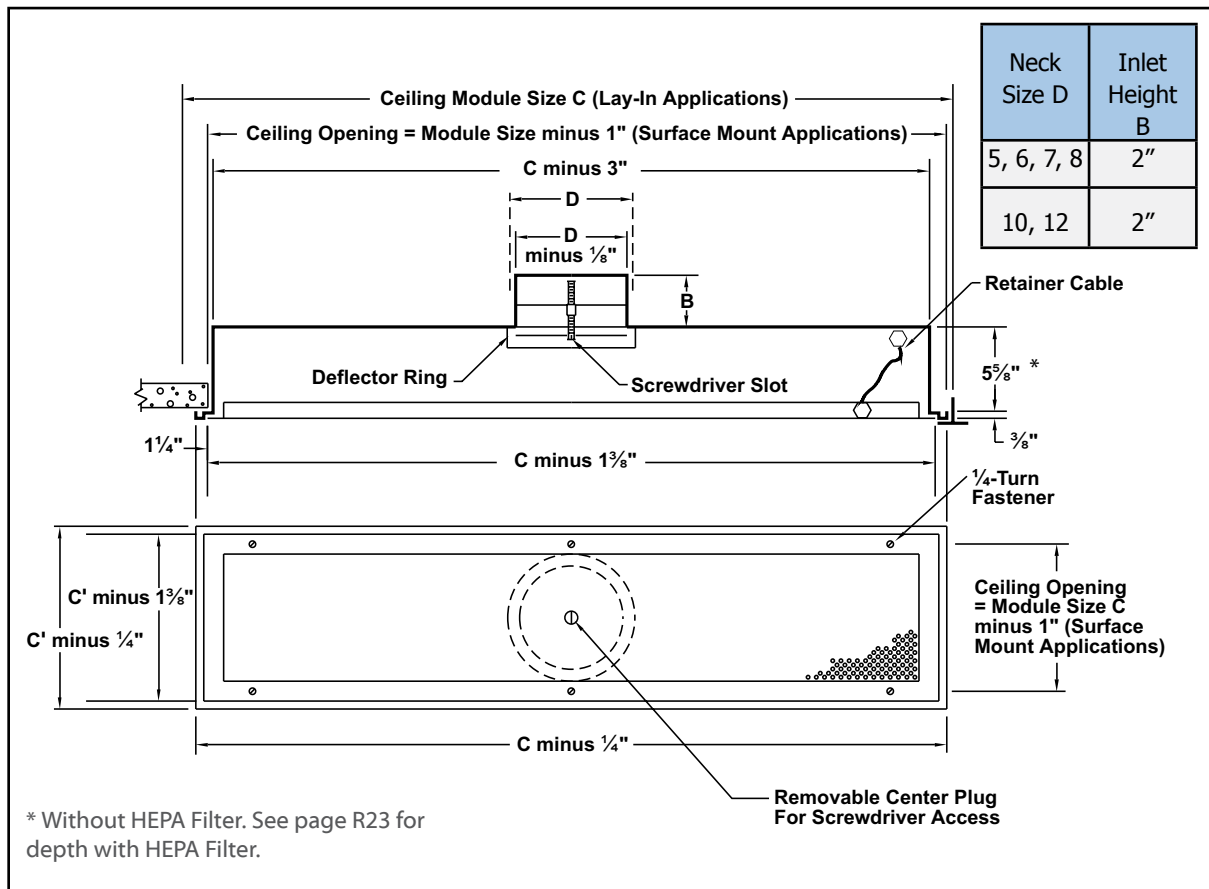
- Standard Finish - #26 White
- Optional Finish - #04 Mill

- Ideal for installation in hospital operating rooms.
- Center plug removes from face for access to screwdriver slot for damper adjustment.
- Perforated face quickly removes by loosening quarter-turn fasteners.
- Retainer cables prevent the perforated face from falling after removal.
- Internal baffles to distribute air evenly over perforated face.



TLF

- Perforated face with $\frac{3}{32}$ -inch diameter holes on $\frac{1}{4}$ -inch centers in a 60° staggered pattern.
- Compatible with 1-inch or 1½-inch T-bar ceiling grids.
- Optional TRM mounting frame available for surface mounting.
- Optional HEPA filter rack on TLF-AA and TLF-SS. (Filter by Titus or others)
- Available in steel, aluminum or 304 stainless steel.



DIMENSIONS

Critical Environment Diffusers

OVERVIEW

TLF laminar flow diffusers are the industry standard for unidirectional flow. When unidirectional flow is desired, typically in areas classified as 1 to 1000, TLF is the choice.

TLF diffusers can be used to create clean zones by positioning the diffuser directly over the area to be washed with clean air. Clean zones are typically used as process areas within a clean room.

TLF diffusers are also used in most operating rooms as the center diffuser and many times these diffusers are surrounded by a linear air curtain. The vertical piston of air created by the TLF is used to discharge clean air over the patient during operations.

Laminar flow minimizes air induction, reducing the opportunity for contaminated air to be re-entrained and pollute a clean airstream.

The TLF Series of laminar flow diffusers generates a low velocity, evenly distributed, downward moving "piston" of conditioned air.

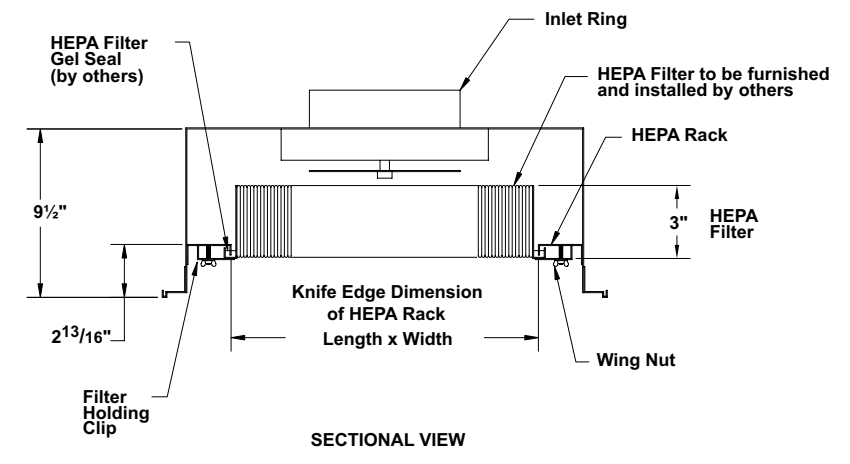
Installed over the operating table in a hospital operating room, TLF diffusers help protect the patient from contaminated room secondary air. The only appreciable amount of room air entrainment occurs at the boundaries of the moving air mass, outside the confines of the operating table. As a result, the patient is effectively isolated from residual room air.

TLF is especially effective in cooling areas with heavy, localized, internal loads, as in computer rooms. The column of air delivered by the TLF cools the load source directly without generating high velocities in the occupied space.

HEPA FILTER OPTION

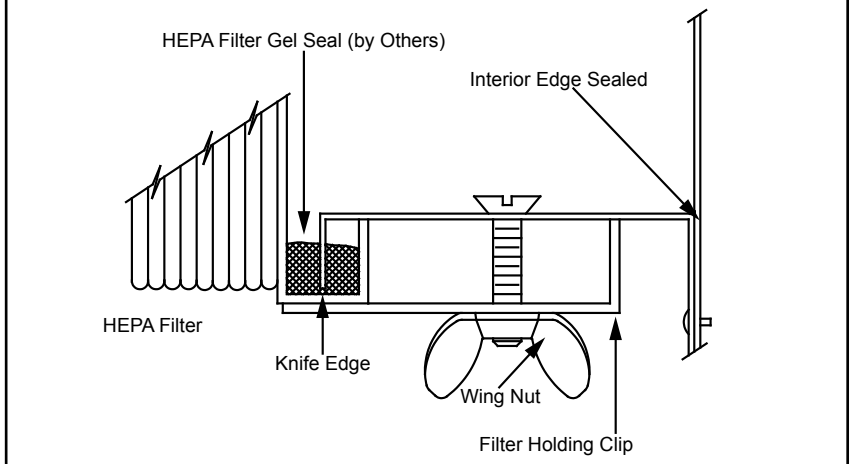
The Air Diffusers marked _____ shall be Titus Model (TLF-SS) (TLF-AA) – HEPA. The diffusers shall be constructed using a 9 inch tall back pan HEPA filter mounting rock and knife edge. The filter, by Titus or others, shall have a Gel Seal that the knife edge fits into. The filter shall be held in place using four #10-24 wing nuts.

TLF-AA/TLF-SS HEPA Filter Dimensions and Mounting Details



Module Size (inches)	Knife Edge Dimensions of HEPA Rack (inches)	
	Length	Width
24 x 12	17 ³ / ₈	5 ³ / ₈
36 x 12	29 ³ / ₈	
48 x 12	41 ³ / ₈	
60 x 12	53 ³ / ₈	
72 x 12	65 ³ / ₈	
24 x 24	17 ³ / ₈	17 ³ / ₈
36 x 24	29 ³ / ₈	
48 x 24	41 ³ / ₈	
60 x 24	53 ³ / ₈	
72 x 24	65 ³ / ₈	
48 x 36	41 ³ / ₈	29 ³ / ₈
60 x 36	53 ³ / ₈	
72 x 36	65 ³ / ₈	

HEPA Filter Rack



TLF, TLF-AA AND TLF-SS

7" Round Inlet	Airflow (CFM)	100	120	140	160	180	220	240	260	300
48" x 12" Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	37	40	44
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-5-6	4-6-7	4-7-8	5-8-9	6-9-10
60" x 12" Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	37	40	44
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-5-6	3-6-7	4-6-8	4-7-8	6-8-9
72" x 12" Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	36	39	43
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-5-6	3-6-7	4-6-8	4-7-8	5-8-9
24" x 24" Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	37	40	44
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-5-6	3-6-7	4-7-8	5-7-8	6-8-9
36" x 24" Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	37	40	44
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-4-5	3-5-6	3-6-7	4-7-8	5-8-9
48" x 24" Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	33	36	39	43
	Vertical Projection	1-2-3	1-2-4	1-3-5	1-4-5	2-4-5	3-5-6	3-6-7	4-7-8	5-7-9

8" Round Inlet	Airflow (CFM)	100	120	140	160	180	220	240	260	300
48" x 24" Module	Total Pressure	0.020	0.027	0.038	0.050	0.062	0.090	0.113	0.130	0.175
	NC (noise Criteria)	-	-	14	18	22	28	31	33	37
	Vertical Projection	1-2-3	1-2-3	1-3-4	1-3-4	1-4-5	2-5-6	2-5-6	3-6-7	4-7-8
60" x 24" Module	Total Pressure	0.020	0.027	0.038	0.049	0.061	0.089	0.109	0.126	0.168
	NC (noise Criteria)	-	-	14	18	22	28	31	33	37
	Vertical Projection	1-2-3	1-2-3	1-3-4	1-3-4	1-4-5	2-5-6	2-5-6	3-6-7	3-7-8
72" x 24" Module	Total Pressure	0.019	0.027	0.037	0.048	0.060	0.088	0.105	0.124	0.162
	NC (noise Criteria)	-	-	14	18	22	28	31	33	37
	Vertical Projection	1-2-3	1-2-3	1-3-4	1-3-4	1-4-5	2-5-6	2-5-6	3-5-7	3-6-8

10" Round Inlet	Airflow (CFM)	215	240	265	295	320	345	400	425	515
48" x 24" Module	Total Pressure	0.043	0.053	0.065	0.080	0.094	0.110	0.147	0.166	0.244
	NC (noise Criteria)	19	22	25	28	31	33	38	40	45
	Vertical Projection	1-4-5	1-4-5	2-5-6	2-5-6	2-6-7	3-6-7	4-8-9	4-8-9	6-10-11
60" x 24" Module	Total Pressure	0.043	0.053	0.065	0.079	0.094	0.110	0.147	0.166	0.244
	NC (noise Criteria)	19	22	25	28	31	33	38	40	45
	Vertical Projection	1-4-5	1-4-5	2-5-6	2-5-6	2-6-7	3-6-7	3-7-8	4-8-9	6-10-11
72" x 24" Module	Total Pressure	0.042	0.052	0.063	0.079	0.092	0.107	0.145	0.163	0.240
	NC (noise Criteria)	19	22	25	28	31	33	38	40	45
	Vertical Projection	1-4-5	1-4-5	2-5-6	2-5-6	2-6-7	3-6-7	3-7-8	4-8-9	6-9-11

12" Round Inlet	Airflow (CFM)	215	240	265	295	320	345	400	425	515
48" x 24" Module	Total Pressure	0.023	0.029	0.035	0.043	0.051	0.059	0.080	0.090	0.132
	NC (noise Criteria)	11	15	18	22	24	27	32	34	40
	Vertical Projection	1-4-4	1-4-5	1-4-5	1-5-6	2-6-6	2-7-7	2-7-8	3-7-8	4-9-10
60" x 24" Module	Total Pressure	0.023	0.029	0.035	0.043	0.051	0.059	0.080	0.090	0.132
	NC (noise Criteria)	11	15	18	22	24	27	32	34	40
	Vertical Projection	1-4-4	1-4-5	1-4-5	1-5-6	2-6-6	2-6-7	2-7-8	3-7-8	4-8-10
72" x 24" Module	Total Pressure	0.023	0.028	0.034	0.042	0.050	0.058	0.078	0.088	0.129
	NC (noise Criteria)	11	15	18	22	24	27	32	34	40
	Vertical Projection	1-4-4	1-4-5	1-4-5	1-5-6	2-5-6	2-6-7	2-7-7	2-7-8	3-8-10

- All data based on full open damper position.
- NC values are based on a room absorption of 10 dB.
- Data obtained in accordance with ASHRAE Standard 70-2006 and ASHRAE Standard 113-2009.
- Throw is based on 0-5° cooling with terminal velocities of 75, 50 and 30 fpm.
- Performance data does not include pressure loss of optional HEPA filter.
- See the section, Engineering Guidelines and the topic 'Procedure to Obtain Catalog Throw Data' in this catalog for throw information.
- Performance data for additional sizes not shown can be obtained by using the Titus TEAMS program.

SUGGESTED SPECIFICATIONS

Critical Environment Diffusers

PERFORMANCE

NC values shall be published. Throw for terminal velocities of 75, 50 and 30 fpm shall be published along with corresponding pressure drop. See the section, Engineering Guidelines and the topic Procedure to Obtain Catalog Throw Data in this catalog for catalog throw information. Performance tests shall have been conducted in ASHRAE Standard 70-2006 and ASHRAE Standard 113-2009.

TLF

Air diffusers marked _____ shall be Titus model number TLF. Diffusers shall be constructed using a maximum 6 inches tall backpan designed for optimum performance with the diffuser without HEPA filters. The backpan shall have integral hanger tabs for securing the unit to the overhead structure. Each unit shall have an integral internal baffle for evenly distributing air over the entire face of the diffuser. Each unit shall have an integral volume damper accessible through the face of the diffuser. The face of the diffuser shall be constructed of 22-gauge steel perforated with ³/₃₂-inch diameter holes on ¼-inch centers. The free area of the face shall be no greater than 13 percent. The face shall be secured in place by quarter-turn fasteners for quick removal and sanitizing. Each unit must have a removable center plug for adjusting the damper.

TLF-AA

Air diffusers marked _____ shall be Titus model number TLF-AA. Diffusers shall be constructed using a maximum 6 inches tall backpan designed for optimum performance with the diffuser when unit is supplied without a HEPA filter. The

backpan shall have integral hanger tabs for securing the unit to the overhead structure to prevent falling in case of earthquakes or other ceiling damage. Each unit shall have an integral internal baffle for evenly distributing air over the entire face of the diffuser. Each unit shall have an integral volume damper accessible through the face of the diffuser. The face of the diffuser shall be constructed of 0.040-inch thick aluminum and shall be perforated with ³/₃₂-inch diameter holes on ¼-inch centers. The free area of the face shall be no greater than 13 percent. The face shall be secured in place by quarter-turn fasteners for quick removal and sanitizing. Each unit must have a removable center plug for adjusting the damper.

TLF-SS

Air diffusers marked _____ shall be Titus model number TLF-SS. Diffusers shall be constructed using a maximum 6 inches tall backpan designed for optimum performance with the diffuser. The backpan shall have integral hanger tabs for securing the unit to the overhead structure to prevent falling in case of earthquakes or other ceiling damage. Each unit shall have an integral internal baffle for evenly distributing air over the entire face of the diffuser. Each unit shall have an integral volume damper accessible through the face of the diffuser. The face of the diffuser shall be constructed of 22-gauge 304 stainless steel perforated with ³/₃₂-inch diameter holes on ¼-inch centers. The free area of the face shall be no greater than 13 percent. The face shall be secured in place by quarter-turn fasteners for quick removal and sanitizing. Each unit must have a removable center plug for adjusting the damper.

MODEL NUMBER SPECIFICATION

Model		Module Size		Material	
TLF	XX	C" x C"	XXX	Steel	XX
TLF-AA		See table below.		304 Stainless Steel	
TLF-SS	XX	XX x XX	EQT	Aluminum	04
XXX-XX		Accessories		H	
Inlet Size	6" 7" 8" 9" 10" 12"	Earthquake Tabs	EQT	White (std.)	26
(Round)		HEPA Filter Rack		H	
Note: For availability of inlet size by module size, see table below.		(TLF-AA & TLF-SS only)			

Available Nominal Ceiling Module Sizes C" x C" and Nominal Round Duct Sizes D"

C" x C"	24 x 12	24 x 24	36 x 12	36 x 24	48 x 12	48 x 24	48 x 36	60 x 12	60 x 24	60 x 36	72 x 12	72 x 24	72 x 36
D"	5, 6, 7	5, 6, 7, 8, 9, 10, 12	5, 6, 7	5, 6, 7, 8, 9, 10, 12	5, 6, 7	5, 6, 7, 8, 9, 10, 12	5, 6, 7, 8, 9, 10, 12	5, 6, 7	5, 6, 7, 8, 9, 10, 12	5, 6, 7, 8, 9, 10, 12	5, 6, 7	5, 6, 7, 8, 9, 10, 12	5, 6, 7, 8, 9, 10, 12

Linear Air Curtain

Critical Environment Diffusers

LineaTec

LINEAR AIR CURTAIN TECHNOLOGY
VERTICAL AIR CURTAIN 2-SLOT
DIFFUSER FOR PERIMETER CONTROL OF
POLLUTANTS

Available Models:

- LineaTec-AL • Aluminum
- LineaTec-SS • 304 Stainless Steel

Finish

- Standard Finish - #26 White Face (aluminum models).
- Optional Finish - #04 Mill Finish (304 stainless steel models and plenums).
- LineaTec provides a curtain of supply air.

- Utilizes a free area slot with an adjustable deflector for maximum efficiency and versatility.
- Face available in 304 Stainless Steel or aluminum.
- Available in single sections up to 6 inches long or multiple sections for continuous runs.
- Available with optional 304 Stainless Steel or aluminum plenums.
- Blank-off sections can be provided to blank-off a single slot.



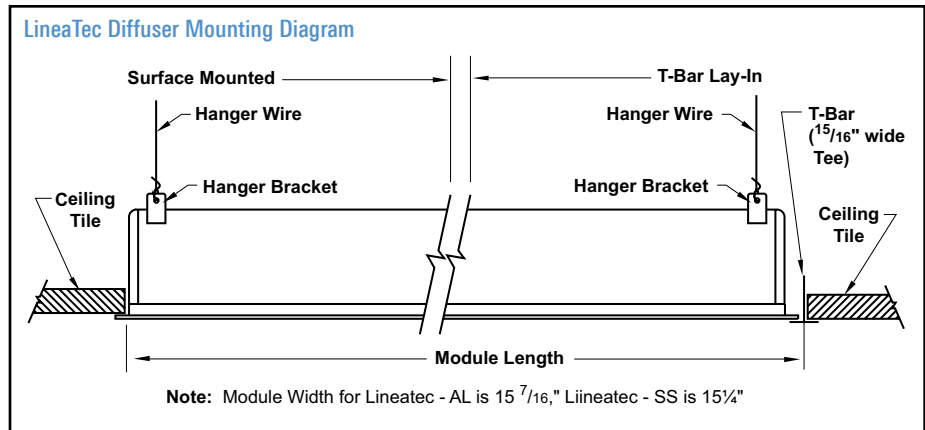
LineaTec

- Plenums available with square or round corners, quarter-turn fasteners for easy face removal and sanitizing.
- Excellent for use as a perimeter air curtain in clean air environments such as operating rooms.
- May be used in surface mount or lay-in applications.

OVERVIEW

LineaTec is a linear air curtain diffuser used to create an air curtain barrier between a clean zone and the balance of the room. The air curtain typically discharges 25 to 50 cfm per linear foot of slot. Flow rates of up to 100 cfm per linear foot of diffuser can be obtained with a two-slot LineaTec. LineaTec diffusers are typically used to surround TLF diffusers in operating rooms to reduce internal contaminants in the sterile zone of the operating theatre. With limited adjustable slots, the air curtain can be directed at a slight angle to facilitate balancing airflow in the entire operating theatre through directional control.

To meet sanitizing requirements, LineaTec diffusers are available with plenums that have optional corners radiused to 3/4-inch. This allows easy manual cleaning of the inside of the plenum when the face is removed and reduces crevices where bacteria and other organisms can grow. Select LineaTec diffusers based on 50 fpm terminal velocity at knee height to 24 inches above floor - for most operating room applications.



Available Single Section Lengths	
Length	Mounting
2'	Surface(1)
3'	Surface(1)
3'6"	Surface(1)
4'	Surface(1)
4'6"	Surface(1)
5'	Surface(1)
5'6"	Surface(1)
6'	Surface(1)
2'	T-bar Lay-In(2)
3'	T-bar Lay-In(2)
4'	T-bar Lay-In(2)

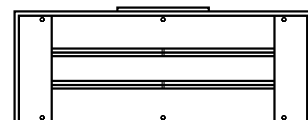
Note 1: May be used as T-bar lay-in by making the T-bar grid nominal unit LineaTec-SS: Length + 3 1/4 inches long by 15 1/4 inches wide. LineaTec-AL: Length + 3 1/16 inches long by 15 1/16 inches wide.

Note 2: Length fits in standard 2-, 3-, or 4-foot T-bar grid. Grid width must be 15 1/4 inches (15 1/16 inches for LineaTec-AL).

LineaTec-AL - Single Unit Construction - Face View



LineaTec-SS - Single Unit Construction - Face View



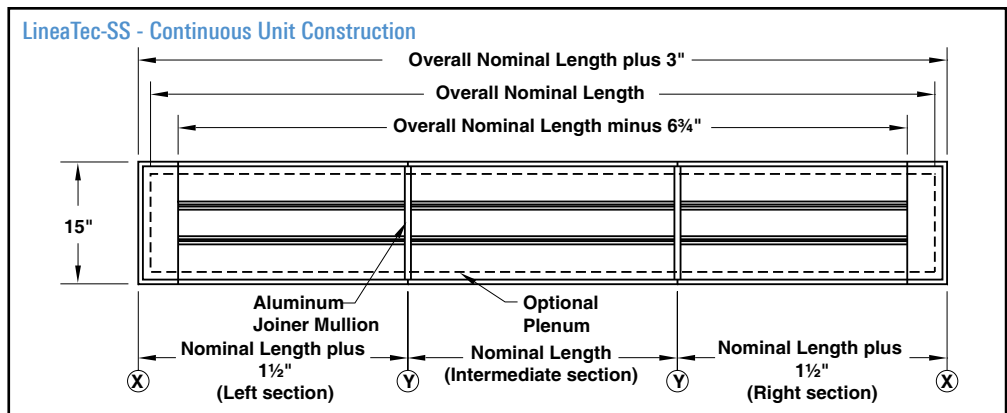
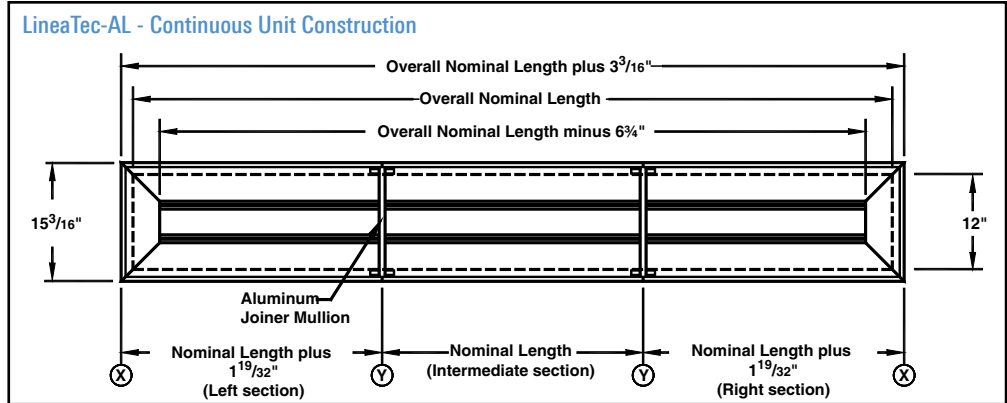
DIMENSIONS

Critical Environment Diffusers

CONTINUOUS UNIT CONSTRUCTION

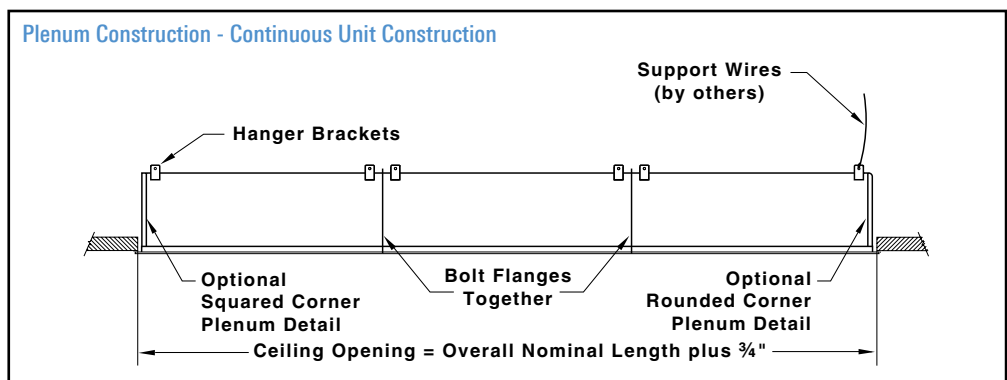
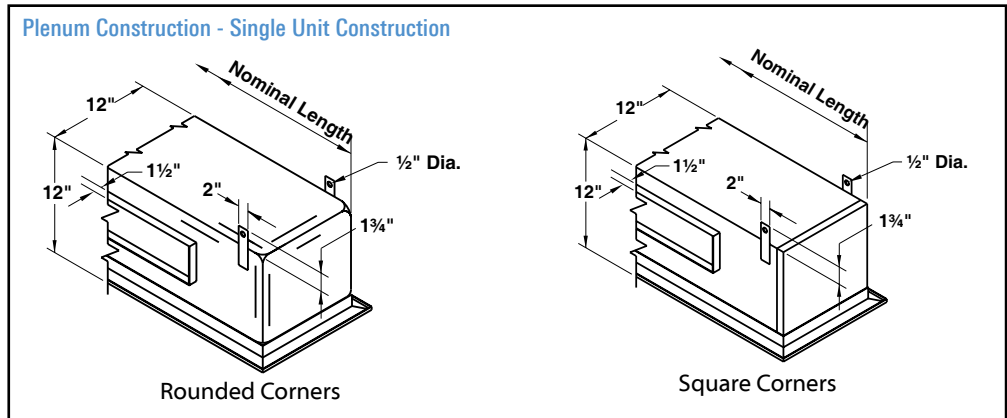
- Connected with aluminum joiner strips

Available Single Section Lengths (ft.)
Length
2'
3'
3'6"
4'
4'6"
5'
5'6"
6'



OPTIONAL PLENUM CONSTRUCTION

- Available with corners rounded ($\frac{3}{4}$ -inch radius) or with square corners.
- Bolted together in the field.
- Hanger brackets included.
- Square or rectangular inlets available in 5-, 6- or 8-inch heights.
- For flange details see page R26.



DIMENSIONS

Critical Environment Diffusers

OPTIONAL PLENUM INLET

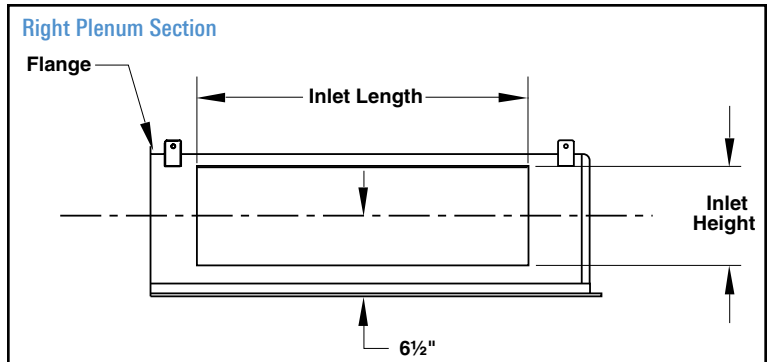
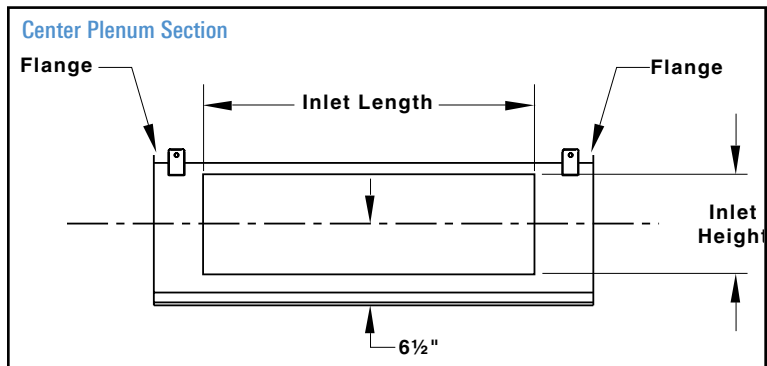
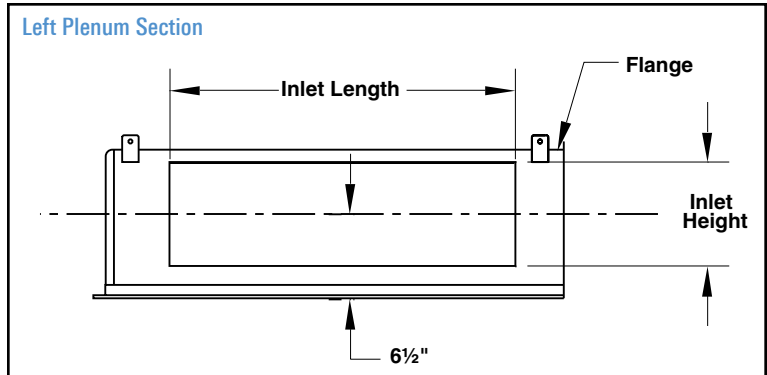
- Inlets centered horizontally.
- 5-, 6- or 8-inch tall inlets available.

Section Length	Maximum Inlet Length
24"	12"
36"	24"
42"	30"
48"	36"
54"	42"
60"	48"
66"	54"
72"	60"

Note: Maximum inlet velocity is 1,000 fpm, 500 fpm is preferred. Operating range of 1-slot unit is 10 cfm/ft to 90 cfm/ft. Operating range of 2-slot unit is 20 cfm/ft to 180 cfm/ft in typical rooms. With higher ceilings, the performance table may be extended to cfm's greater than those shown.

Note: Inlet heights available are 5, 6 or 8 inches.

Note: Each linear diffuser should have a supply duct connection.



LINEATEC-AL AND LINEATEC-SS

1-Slot	Airflow, cfm/Ft.	10	20	30	40	50	60	70
	Static Pressure	0.004	0.015	0.034	0.061	0.095	0.136	0.186
	NC (Noise Criteria)	<10	<10	<10	<10	13	16	19
	Throw	0-1-3	1-3-6	3-4-7	4-6-8	5-6-9	6-7-10	6-7-11
2-Slot	Airflow, cfm/Ft.	20	40	60	80	100	120	140
	Static Pressure	0.004	0.015	0.034	0.061	0.095	0.136	0.186
	NC (Noise Criteria)	<10	<10	<10	19	26	31	37
	Throw	0-1-4	2-4-8	4-6-10	6-8-11	7-9-(13)	8-10-(14)	9-11-(15)

- NC is based on a 6-foot unit.
- Throw is based on isothermal air, vertical, in a room between 0 and 11 feet high, for 150, 100 and 50 fpm terminal velocities, for a 6-foot unit.
- For cold air, throw will increase, heated air will not project as far as shown; See the section, Engineering Guidelines and the topic, 'Estimating Downward Vertical Projection' in this catalog for additional information.
- Throw data included in () parenthesis is calculated to exceed floor to ceiling distance for the terminal velocities shown.
- Static pressure shown assumes Titus recommended plenum.
- Data is based on a factory provided plenum with 3/4-inch radius corner and an 18 x 6-inch inlet.



SUGGESTED SPECIFICATIONS

PERFORMANCE

NC values representing the noise criteria curve shall be published. Throw values for terminal velocities of 150, 100, and 50 fpm shall be published along with corresponding pressure drop. Performance shall be based on a factory manufactured plenum. Performance tests shall have been conducted in accordance with ASHRAE Standards 70-2006 and ASHRAE Standard 113-90.

LINEATEC-AL

Linear air diffusers marked _____ shall be Titus model number LineaTec-AL. Diffusers shall be constructed for a 12-inch wide plenum. The diffuser shall be a two-slot design with provision for disabling one slot. Diffuser shall be available in one piece construction up to 6 feet long or multiple piece construction for longer lengths. Multisection diffusers shall include joiner mullions. Slots shall include adjustable blades with a minimum adjustment range of 5° to 15°. Diffuser shall be constructed of heavy gauge extruded aluminum. An outer extruded frame and factory manufactured aluminum plenum shall be installed on the diffuser.

The diffuser must have quarter-turn fasteners for quick and easy removal from the plenum. The plenum shall have all outer corners radiused with a 3/4-inch, minimum, radius.

Critical Environment Diffusers

(Option-the plenum shall have square corners.) The plenum inlet shall be 5, 6 or 8 inches high and of sufficient length to reduce the velocity of incoming air to 1,000 fpm or less.

LINEATEC-SS

Linear air diffusers marked _____ shall be Titus model number LineaTec-SS. Diffusers shall be constructed for a 12-inch wide plenum. The diffuser shall be a two-slot design with provision for disabling one slot. Diffuser shall be available in one piece construction up to 6 feet long or multiple piece construction for longer lengths.

Multisection diffusers shall include joiner mullions. Slots shall include adjustable blades with a minimum adjustment range of 5° to 15°. Diffuser shall be constructed of minimum 22-gauge 304 stainless steel with a #04 brushed finish. An outer frame and factory manufactured 304 stainless steel plenum shall be installed on the diffuser and shall have a mill finish. The diffuser must have quarter-turn fasteners for quick and easy removal from the plenum. The plenum shall have all outer corners radiused with a minimum 1/4-inch radius. (Option-the plenum shall have square corners.) The plenum inlet shall be 5, 6 or 8 inches high and of sufficient length to reduce the velocity of incoming air to 1,000 fpm or less.

MODEL NUMBER SPECIFICATION

Model	Nominal Length	Number of Inlets	Inlet Height	Inlet Width	Corner Construction	Accessories	Finish (Note)
LineaTec-AL LineaTec-SS	XXXXXXXX-XX	X	X	X	X	X	White (std.) Mill
	Specify	Specify	5" 6" 8"	(Specify to the nearest 1" increment. Maximum length is section size minus 12"). Note: Inlet is actual size.	Square Corners 3/4" radius vertical and horizontal corners (does not apply to inlet)	One-Slot Blank-Off Plate R	26 04

Note: Finish applies to face only. Plenum is mill finish. Standard finish: Aluminum - White; Stainless Steel - Mill
Mill finish only available on stainless Steel models.

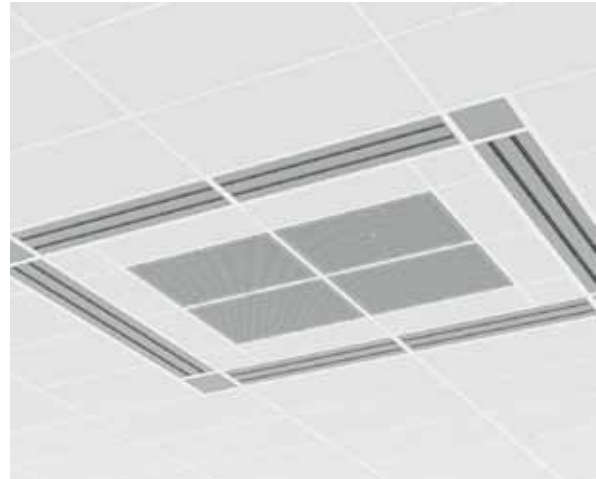
SteriTec

STERILE ENVIRONMENT SYSTEM TECHNOLOGY

Available Models:

- SteriTec-AL • Aluminum
- SteriTec-SS • 304 Stainless Steel

- Perforated pressure induction plate facilitates balancing.
- Blades have minimum adjustability to allow precise control of the air curtain angle.
- Optional blank-off plate is available for closing off one slot.
- May be mounted as surface mount or T-bar lay-in with support.
- Available in square sizes from 8 x 8 feet through 20 x 20 feet as listed below. Rectangular sizes are also available.
- Other custom sizes are available.
- Two-slot perimeter air curtain for creating an air wall between clean zones and adjacent area.
- Unique corner transition allows the entire plenum system to be visible for cleaning by hand.
- Face quickly removes for easy plenum access.
- Unique corner covers provide neat appearance.



SteriTec

- Available with optional 304 stainless steel or aluminum plenums.
- Corner transitions are full plenum size creating no airflow restriction.
- Available with round corners on plenums (3/4-inch radius) or square corners on plenums
- Continuous plenums minimize duct runs and facilitates self balancing.
- Typical linear selection for 50 fpm terminal velocity 2 feet above floor.

Nominal Sizes ft. "A" x "B"	Laminar Flow No. of Units & Sizes Units @ 30cfm/ft ²		Linear Diffuser No. of Sections		Total		
			Side A	Side B	Laminar Flow cfm	LineaTec @ 40 cfm/ft cfm	cfm
8' x 8'	6-3x2	1296	2	2	1296	1200	2575
10' x 10'	8-2x4	1920	2	2	1,920	1,600	3,520
12' x 12'	8-2x4	1920	2	2	1,920	1,920	3,840
14' x 14'	10-2x4 2-2x6	3120	2	2	3,120	2,240	5,360
16' x 16'	10-2x4 2-2x6	3120	3	3	3,120	2,560	5,680
18' x 18'	18-2x4	4320	3	3	4,320	2,380	7,200
20' x 20'	32-2x4	7680	4	4	7,600	3,200	10,800

Note: Please check with your Titus representative before specifying sizes other than those listed above. See page R37. Rectangular sizes are available.

OVERVIEW

Critical Environment Diffusers

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According to the new proposed ASHRAE standard for critical hospital operating rooms, the laminar flow diffusers should be selected for an average velocity not to exceed 35 fpm at the operating table. This is about equal to the normal plumage velocity emitted from the human body. This velocity can be calculated by taking airflow from the laminar flow diffusers and dividing this flow by the nominal face area of the diffusers. The size of the laminar flow field or many times called the "serial field," should be at least the size of the operating table plus an additional area of 12 inches around the table. This is the absolute minimum size. However, many times additional equipment and tables are required and also need to be included in this sterile field. The sterile field should protect the patient and provide non-contaminated airflow protection for the patient, all equipment and personnel being used for the patient.

The terminal velocity of the laminar flow on the patient should not be greater than the plumage velocity created by the normal human body at rest. This limitation is meant to stop the laminar flow from driving contamination into open wounds during surgery the plumage velocity is approximately 25-35 fpm.

Ceiling area can be allowed in the sterile field for lighting and related services. Data has shown that if an air wall or air curtain like the SteriTec is used, room airflow entrainment is drastically reduced into the laminar flow sterile field with as much as 30% of the sterile field used for related services. Tests, conducted at the Titus laboratory, have shown the importance of this air wall or air curtain. If an air curtain is not used as shown for both a side view and a plan view contamination can and will be induced into the center of the sterile field. The migration of contamination has also been observed if the laminar diffusers are continuous over the operating room table and an air curtain has not been used. As shown, the inside edge of the SteriTec system air wall or air curtain should be mounted 12 to 30 inches outside the TLF generated

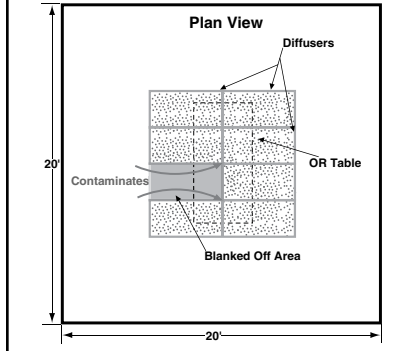
nominal sterile field. The total airflow requirement varies with the room size. The recommended minimum airflow is 20 air changes per hour for class B and C operating rooms.

The side view of the SteriTec air curtain shows how this system stops room airflow induction into the laminar flow field at two very important locations. The first location is next to the ceiling. If the laminar flow is not continuous, and many times this is not the case due to lighting and gas columns etc., the air wall stops the induction along the ceiling line from being drawn into the laminar flow. The openings in the field can and does provide a material pathway for airflow to flow into the openings between the laminar flow diffusers. This then can allow secondary room airflow to flow into these areas which may be contaminated. The second area of protection is seen further down in the room. The SteriTec air curtain provides an invisible barrier or wall to reduce room air from being mixed with the pure filtered clean laminar flow from the TLF diffusers.

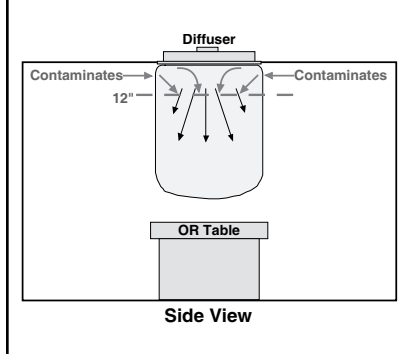
Contaminated air outside the air curtain is prevented from entraining or being mixed with the clean zone created and inside the LineaTec diffusers zone. In most applications the LineaTec diffusers of the SteriTec system are selected for a terminal velocity of 50 fpm about 2 Feet above the floor. This allows the flow to travel down to and along the floor to the external low sidewall exhaust return grilles.

The SteriTec system combines the features of the TLF and the LineaTec to form a clean zone within a clean room. A typical SteriTec system for an operating room of class B or C includes a LineaTec perimeter air curtain and with TLF laminar flow TLF diffusers as the central supply air outlets. Return grilles are located at the low level sidewall as exhaust outlets on at least two of the room's walls. These are typically mounted so the lower portion of the grille frame is about 8 inches above the floor to allow cleaning of the room's floor.

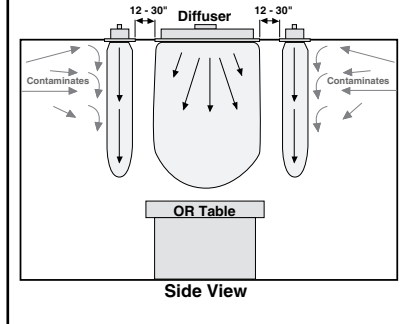
No Air Curtain - Contamination - Not Blocked At Ceiling



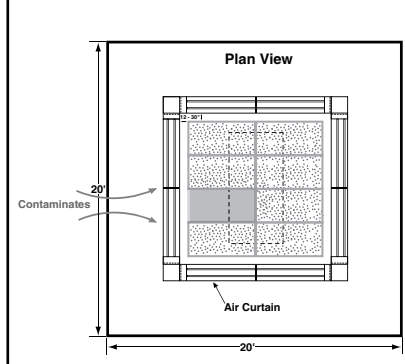
Laminar Flow With No Air Curtain



Laminar Flow With Air Curtain



Air Curtain With Non-continuous Laminar Flow - Contamination Blocked



DIMENSIONS

Critical Environment Diffusers

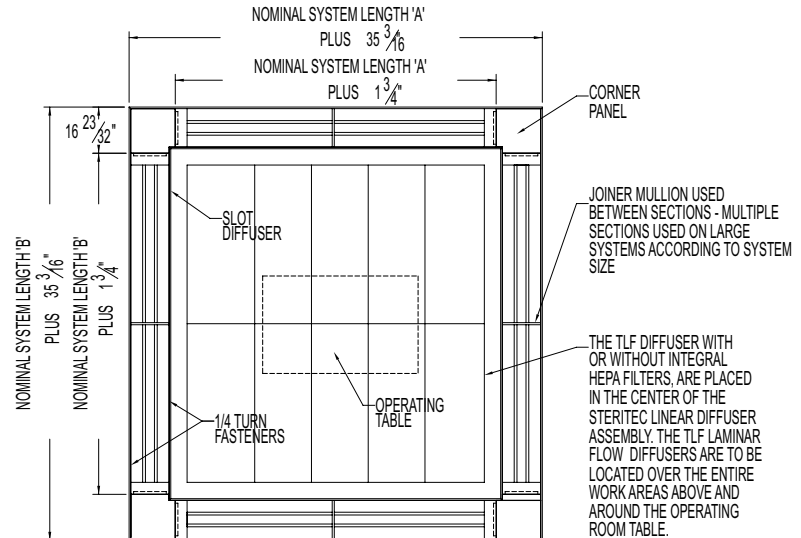
Material:

- **SteriTec-AL**
Extruded aluminum face with 20-gauge aluminum plenum.
- **SteriTec-SS**
20-gauge 304 stainless steel face and plenums.

Finish

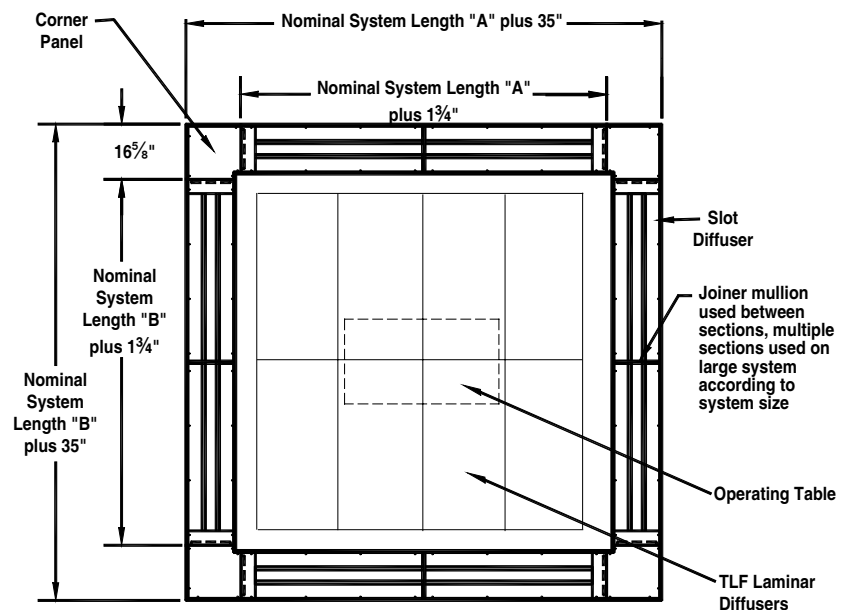
- **Standard Face Finish**
SteriTec-AL - #26 White Face
SteriTec-SS - #04 Mill
- **Standard Plenum Finish**
Optional Finish - #04 Mill

SteriTec-AL - Face View



Note: Outside ceiling opening for surface mounting is nominal system length + 34 inches. Outside T-bar grid dimensions for T-bar lay-in mounting are nominal system length + $35\frac{7}{16}$ -inch.

SteriTec-SS - Face View



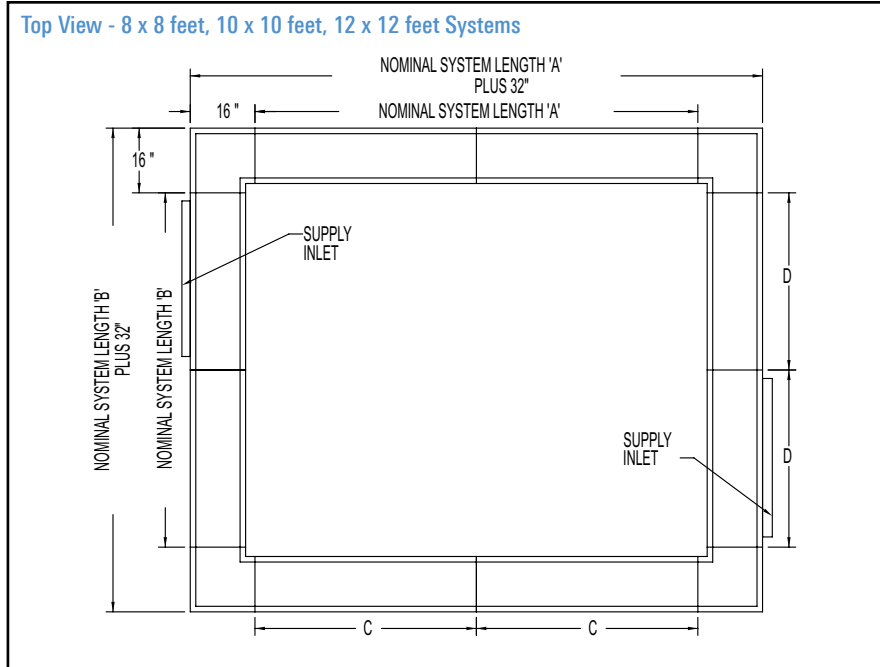
Note: Outside ceiling opening for surface mounting is nominal system length + 34 inches. Outside T-bar grid dimensions for T-bar lay-in mounting are nominal system length + $35\frac{1}{4}$ -inch.

DIMENSIONS

Critical Environment Diffusers

PLENUMS INCLUDE:

- Optional 3/4-inch radius on horizontal and vertical plenum corners (inlet does not have radius).
- Continuously welded seams ground smooth to make hand cleaning easy.
- Corners have no crevices on radiused plenums to trap contaminants or mold.
- 12-inch width to facilitate cleaning.
- Optional square cornered plenums with tightly fitted end caps spot-welded in place.
- Plenums have heavy duty hanger brackets for suspending the entire system from the structure.
- Multi-section plenums bolt together using heavy duty flanges.

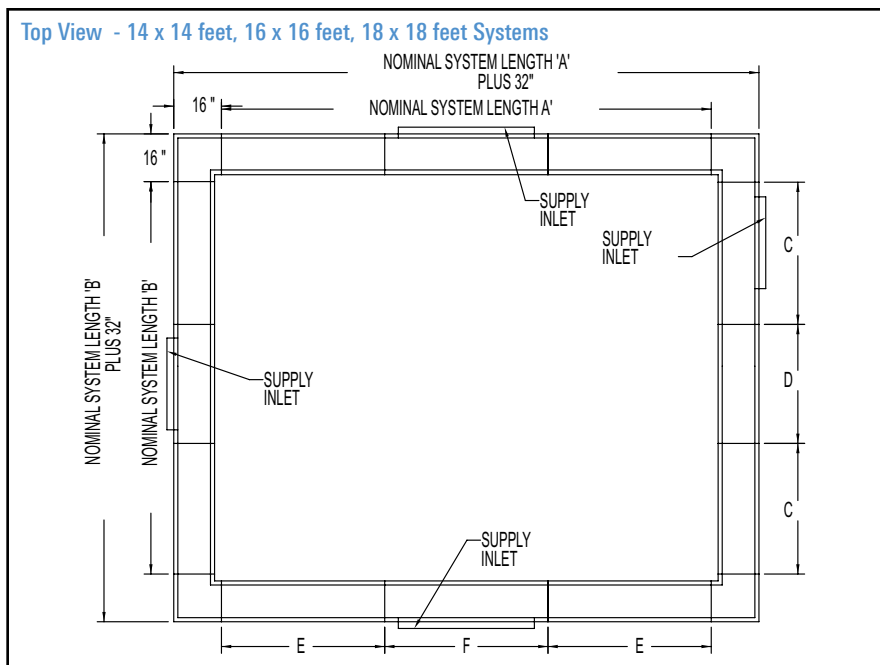


System Nominal Size (ft)	Nominal Plenum Length (ft)			
	C	D	E	F
8 x 8	4	4	–	–
10 x 10	5	5	–	–
12 x 12	6	6	–	–
14 x 14	4½	5	4½	5
16 x 16	5½	5	5½	5
18 x 18	6	6	6	6

Rectangular sizes are available.

NOMINAL PLENUM LENGTHS

Note: Use the chart shown at right for identifying nominal plenum section lengths by system size.



DIMENSIONS

Critical Environment Diffusers

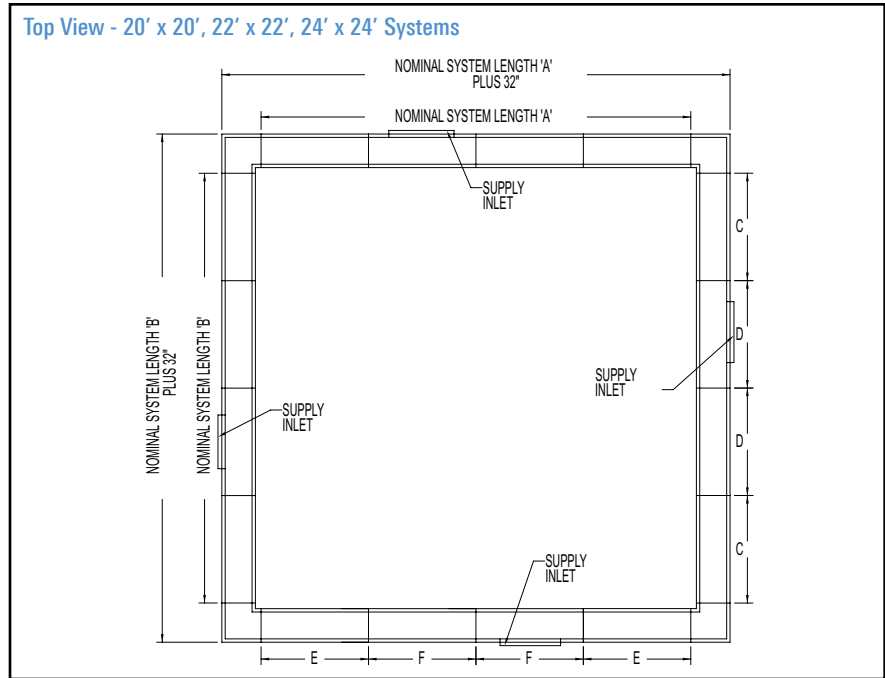
NOMINAL PLENUM LENGTHS

Note: Use the chart shown at right for identifying nominal plenum section lengths by system size.

FLANGE AND HANGER BRACKET DETAILS

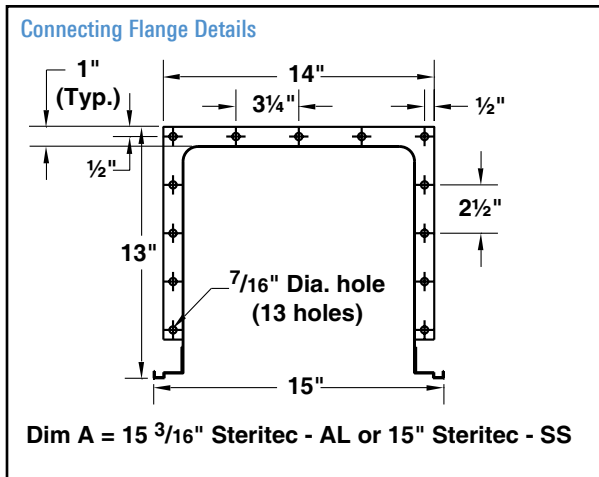
Note: All systems must be suspended by wire whether surface mount or lay-in.

Top View - 20' x 20', 22' x 22', 24' x 24' Systems

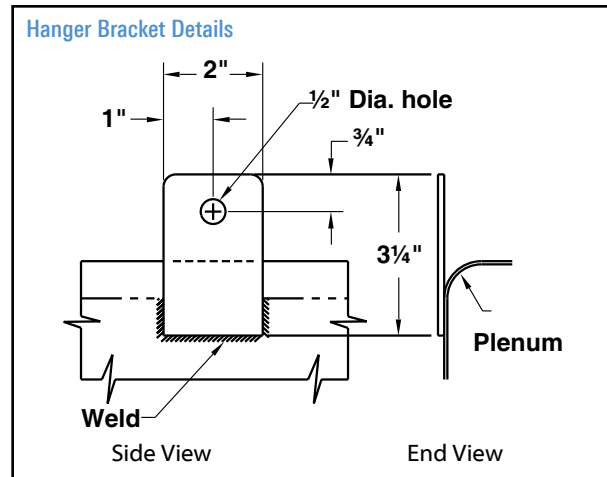


System Nominal Size (ft)	Nominal Plenum Length (ft)			
	C	D	E	F
20 x 20	5'	5'	5'	5'

Connecting Flange Details



Hanger Bracket Details



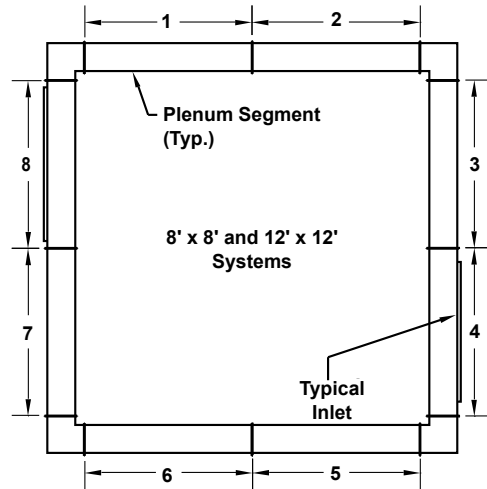
PLENUM INLET LOCATIONS

Note: Inlets should be of equal size. Maximum inlet size is 8 inches tall by the section length minus 12 inches. Inlet velocity should be kept to less than 800 fpm, preferably less than 500 fpm.

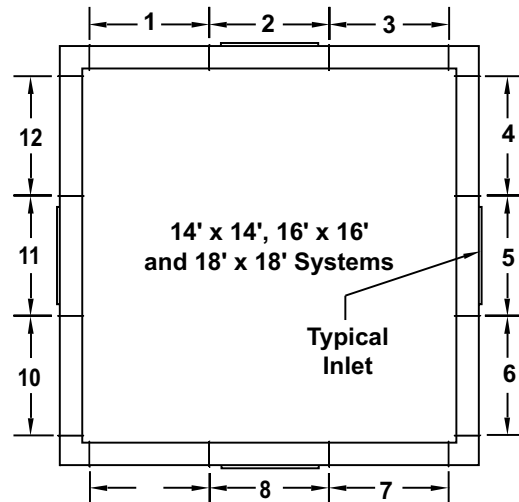
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Critical Environment Diffusers

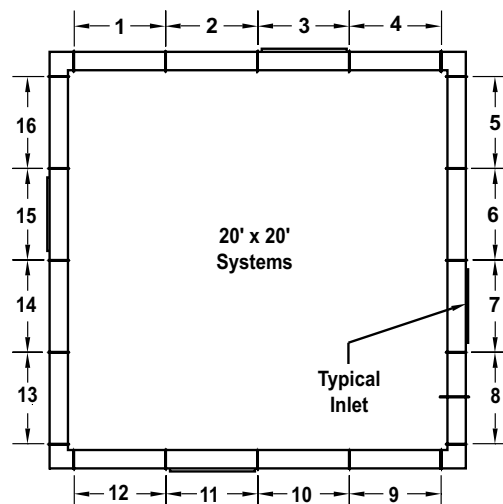
System Layout A - Top View



System Layout B - Top View



System Layout C - Top View



SUGGESTED SPECIFICATIONS

STERITEC

Linear air curtain system marked _____ shall be Titus SteriTec system. Linear diffusers shall be constructed for a 12-inch wide plenum. The diffuser shall be a two-slot design with provision for blanking off one-slot. Linear diffusers shall include pressure induction plates for automatic balancing of airflow. Slots shall include adjustable blades with a minimum adjustment range of 5° to 15°. Diffuser shall be constructed of heavy extruded aluminum (or 20-gauge 304 stainless steel for SteriTec-SS).

An outer frame and factory manufactured plenum shall be installed on the diffuser. The diffuser must have quarter-turn fasteners for quick and easy removal from the plenum. The plenum shall have all outer corners radiused with a 3/4-inch, minimum, radius.

All welded joints shall be ground smooth. (Option-plenums shall have square corners.) Plenums must be connected at all joints using bolt together flanges. The system shall have _____ inlets which shall be 5, 6 or 8 inches high and be of sufficient length to reduce the velocity of incoming air to _____ fpm or less. The corners of the system shall be interconnected using transition elbows with removable face covers. Corner transitions shall not reduce the cross

Critical Environment Diffusers

sectional area of the plenum. Removable face covers shall expose the entire corner section of the plenum for cleaning and visual inspection.

Center diffusers shall be Titus model number _____ (see model specification).

System parameters shall be as follows:

Room Volume _____ ft.³

Air Changes Per Hour _____

Nominal System Size
_____ ' x _____'

Total System cfm _____

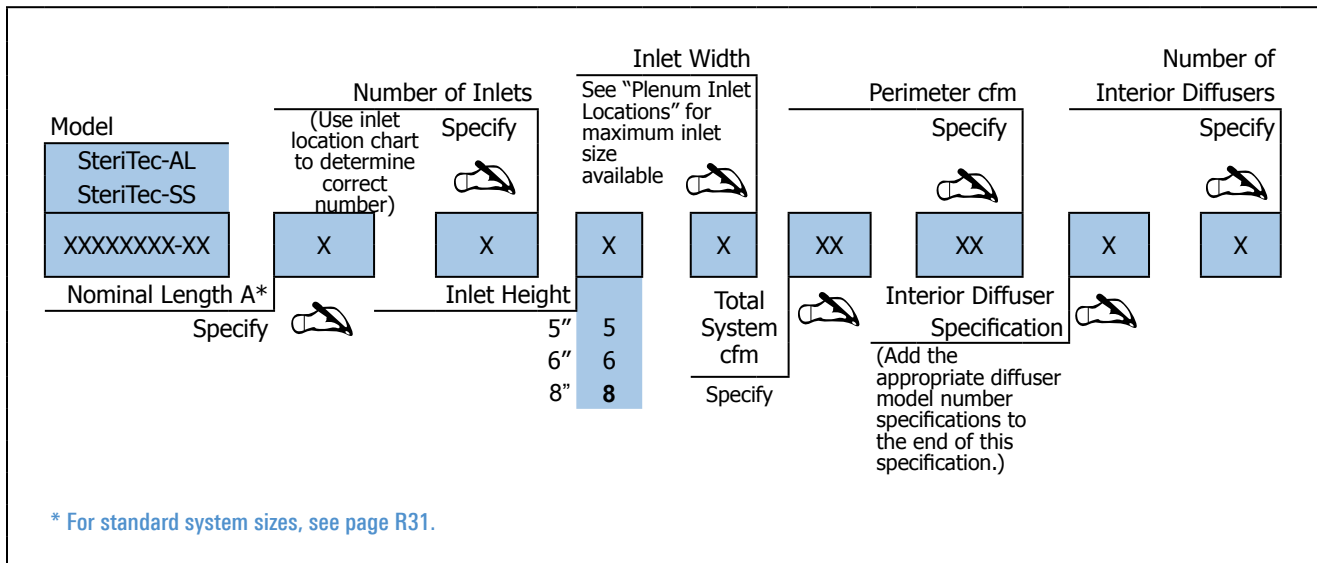
Perimeter Air Curtain cfm _____

Number of TLF Diffusers _____

cfm/TLF Diffuser _____

cfm/Linear ft. of Slot Diffuser _____

MODEL NUMBER SPECIFICATION

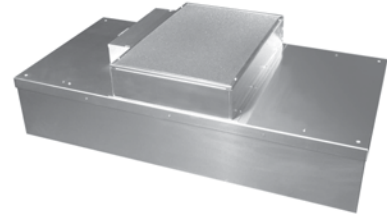


Fan Filter Diffusers

Critical Environment Diffusers

Available Models:

- | | |
|-------|---|
| FFD | • PSC motor / HEPA Filter |
| FFDE | • ECM motor / HEPA Filter |
| FFDR | • PSC motor / Room side replaceable HEPA Filter |
| FFDER | • ECM motor / Room side replaceable HEPA Filter |



Fan Filter Diffusers

INTRODUCTION

Fan filter diffusers provide a unique solution in clean room applications. In situations where the use of conventional ducted modules is impractical or the air supply has insufficient static pressure to move the air through a HEPA filter, fan filter diffusers provide an excellent alternative. In cleanroom design, the primary factor is contaminant removal and the cleanliness level, so moving the air is a major challenge. The volume of recirculated HEPA filtered air, including conditioned air to handle high cooling loads that are typical of many cleanrooms, can range from less than twenty to more than five hundred air changes per hour. Fan filter diffusers provide a constant flow of clean air into the space which prevents the infiltration of contaminants and provides for the removal of particles generated by people and equipment in the work space.

quietest fan filter diffusers in the industry. The room side replaceable option (R) provides quick and efficient replacement of the HEPA or ULPA filter from room side while the diffuser remains in place.

Titus fan filter diffusers are also available with an ECM brushless DC motor. These units dynamically adjust themselves to maintain the set airflow, compensating for changes in static pressure, filter loading or other local conditions. Titus fan filter diffusers with ECM can easily maintain cleanroom air levels exceeding IEST recommended practices. Airflow is maintained so constantly and consistently that the need for future balancing is greatly reduced. The ECM option, along with the patented baffling system and forward curve fan, makes Titus fan filter diffusers intelligent, energy efficient and ultra quiet.

TITUS FAN FILTER DIFFUSERS...LOW ENERGY· LOW SOUND AND LOW PROFILE

Titus offers a complete line of fan filter diffusers that can be used for new design or retrofitting cleanroom environments. Each Titus FFD (fan filter diffuser) is a self-contained fan filter module that includes HEPA filter, pre-filter, fan speed control and low profile design. Air circulation is maintained by using a lightweight, forward curved fan powered by a 120V or 277V, 60Hz motor. Motor speed is adjusted by the solid-state speed control mounted on top of the housing. Patented baffling technology ensures uniform airflow across the filter face and attenuates sound for one of the

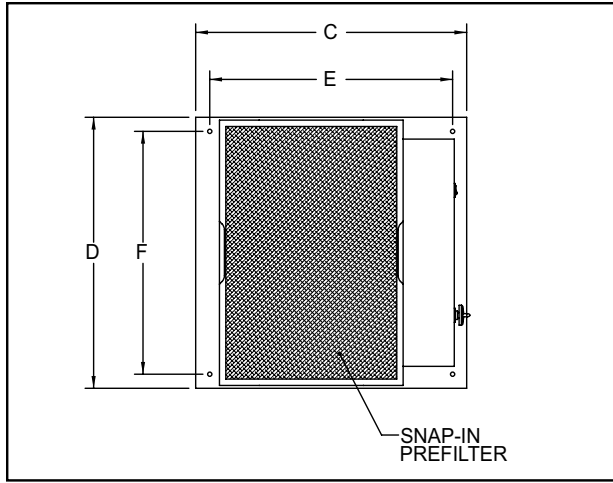
- Low profile design.
- PSC or ECM motor.
- Solid state, visual, or infrared speed control.
- Walkable plenum (excluding prefilter).
- UL listed (120V, 277V).
- Standard sizes: 24" x 24" and 48" x 24".
- Aluminum construction (stainless steel optional).
- Options: Duct collar, challenge port, ULPA filter, power cord.



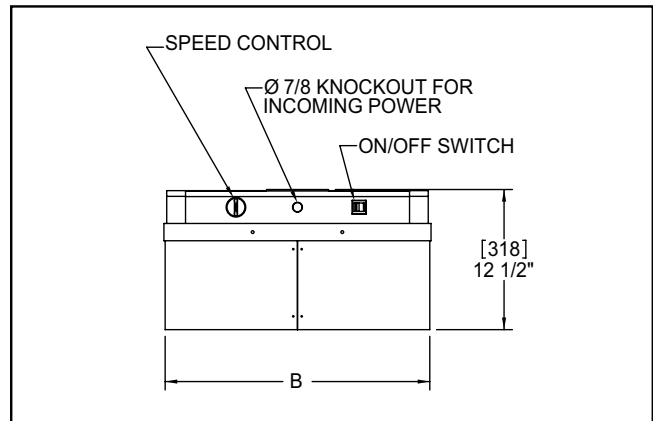
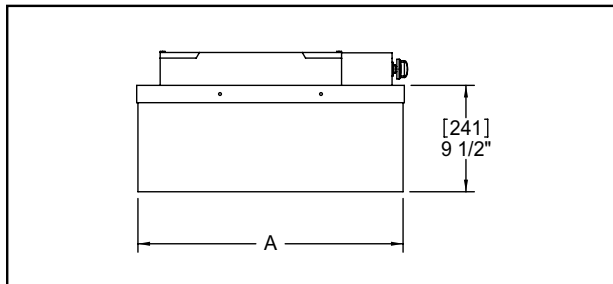
DIMENSIONS

Critical Environment Diffusers

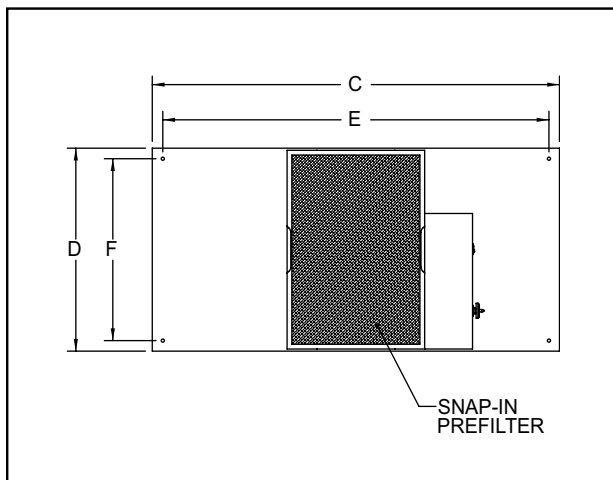
24X24 FFD



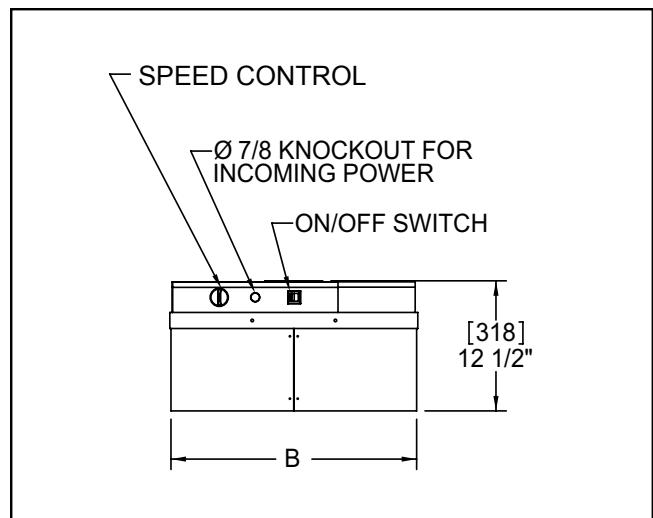
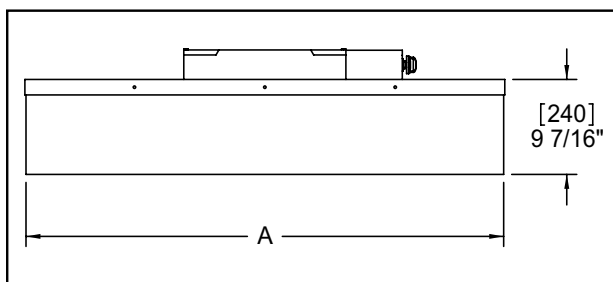
A	B	C	D
In (mm)	In (mm)	In (mm)	In (mm)
23 5/8	23 5/8	23 11/32	23 11/32
(600)	(600)	(606)	(606)



48X24 FFD



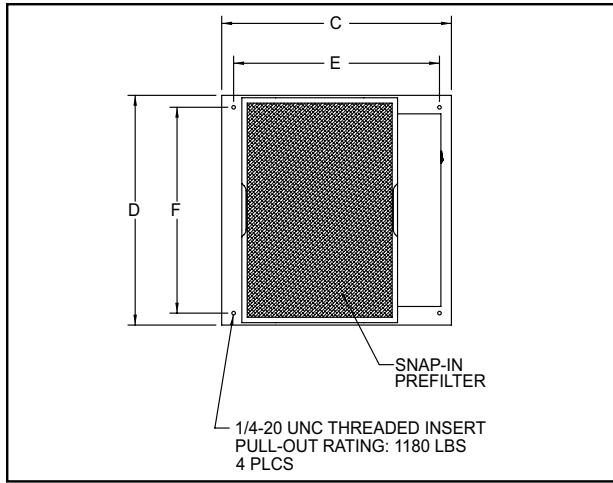
A	B	C	D
In (mm)	In (mm)	In (mm)	In (mm)
47 5/8	23 5/8	47 11/32	23 11/32
(1210)	(600)	(1215)	(606)



DIMENSIONS

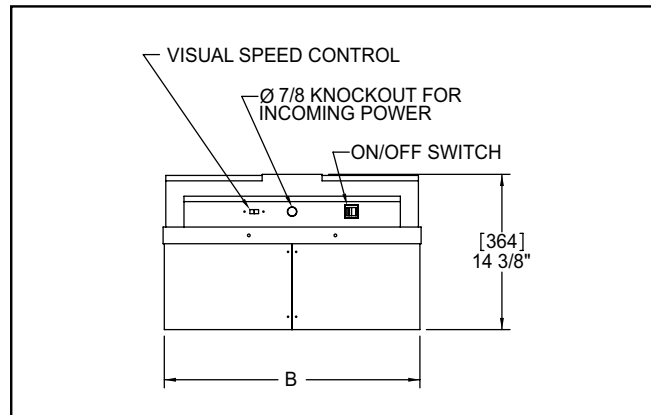
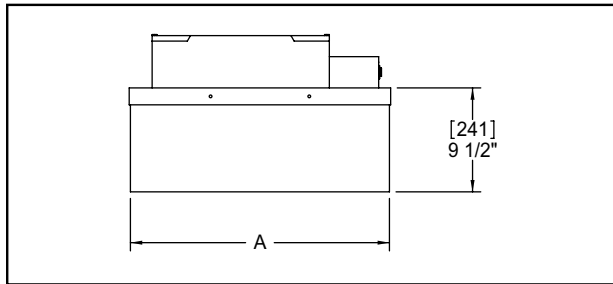
Critical Environment Diffusers

24X24 FFDE

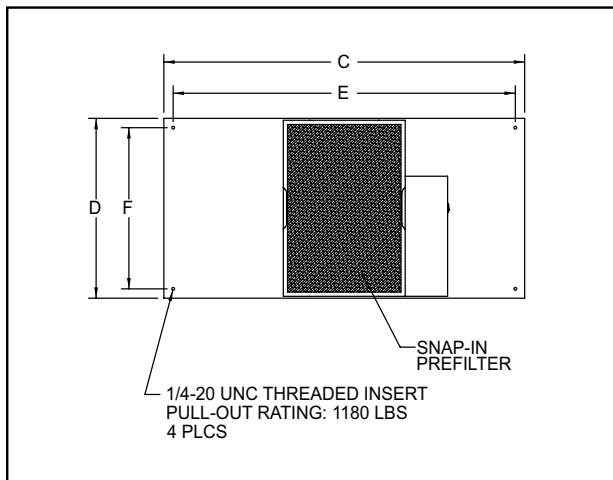


A	B	C	D	E	F	Unit Weight
In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	41 lbs.
23 5/8	23 5/8	23 11/32	23 11/32	21 3/8	21 3/8	
(600)	(600)	(606)	(606)	(543)	(543)	

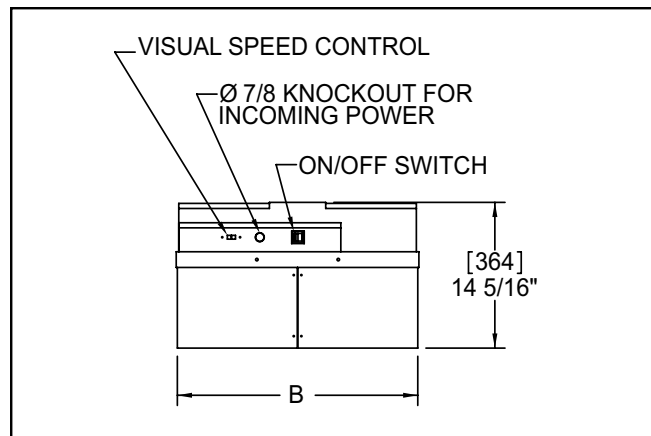
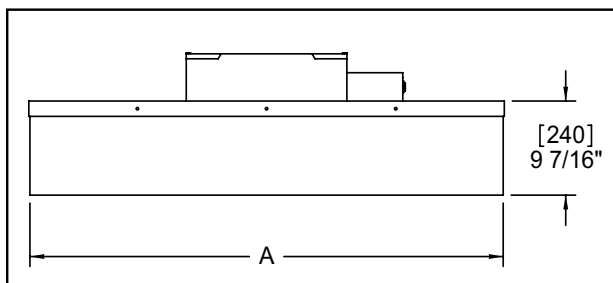
Note: The maximum inlet static pressure is 0.3 inches of water gauge. Operating above the maximum may adversely affect the performance of the unit and is not recommended.



48X24 FFDE



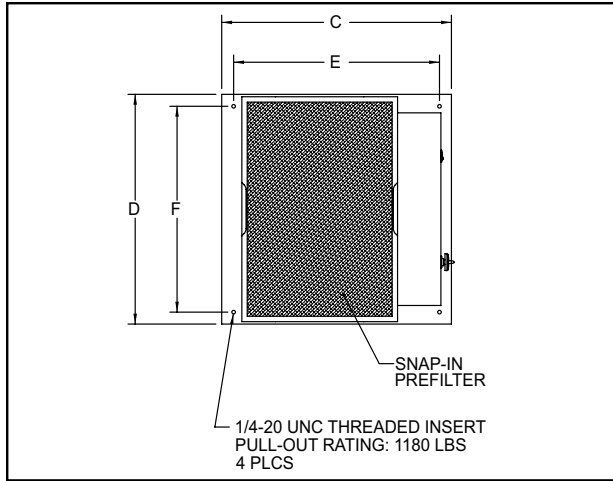
A	B	C	D	E	F	Unit Weight
In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	62 lbs.
47 5/8	23 5/8	47 11/32	23 11/32	45 3/8	21 3/8	
(1210)	(600)	(1215)	(606)	(1152)	(543)	



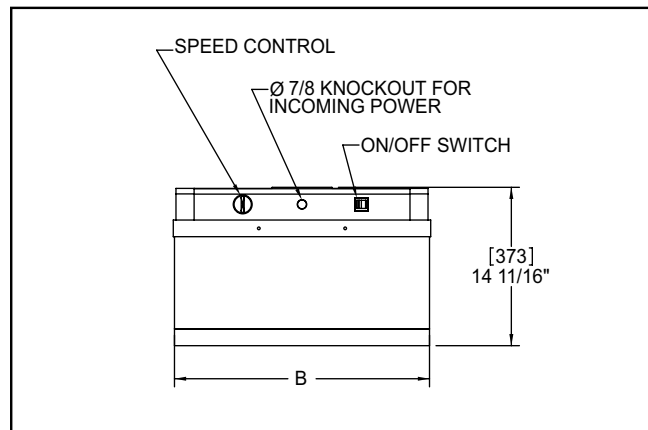
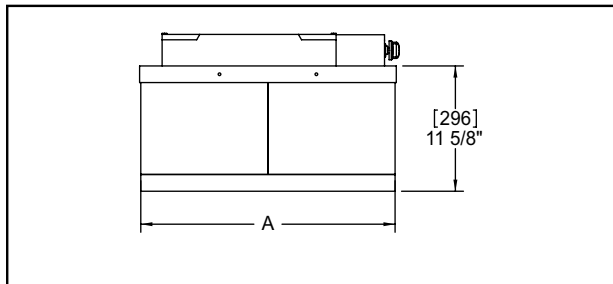
DIMENSIONS

Critical Environment Diffusers

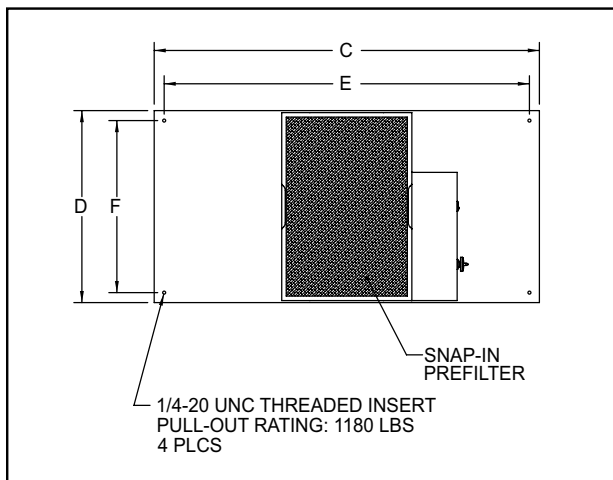
24X24 FFDR



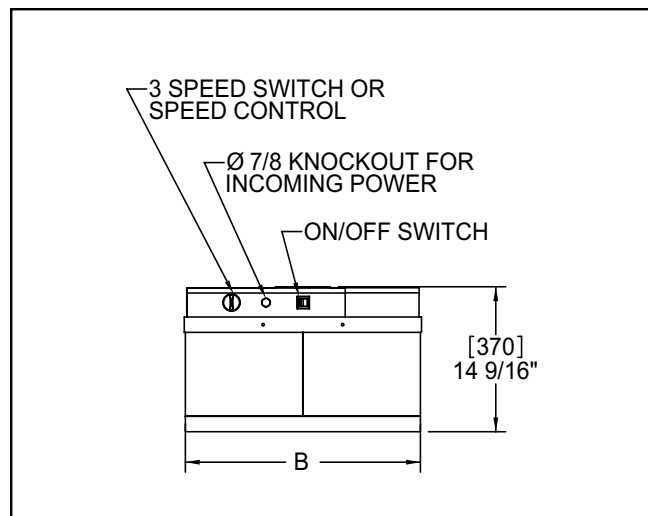
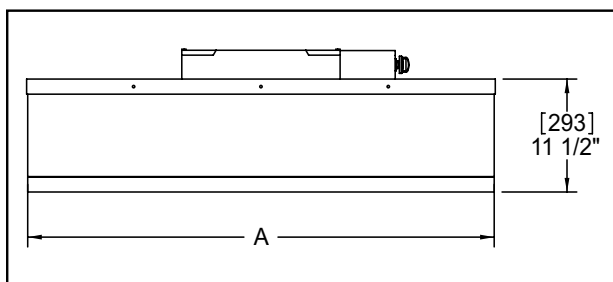
A	B	C	D	E	F	Unit Weight
In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	44 lbs.
23 5/8	23 5/8	23 11/32	23 11/32	21 3/8	21 3/8	
(600)	(600)	(606)	(606)	(543)	(543)	



48X24 FFDR

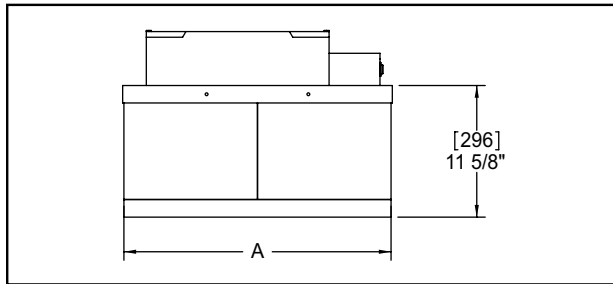
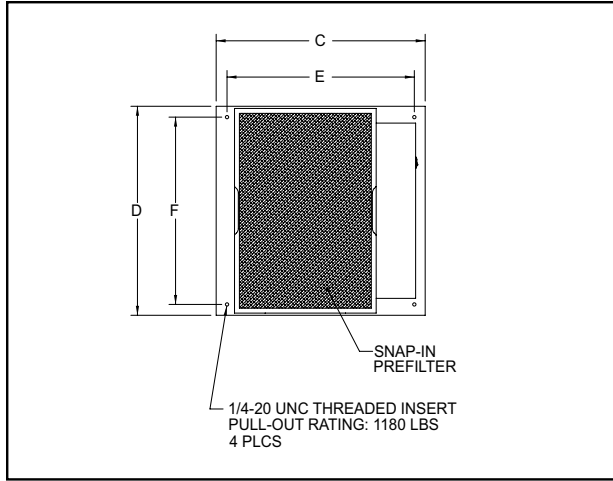


A	B	C	D	E	F	Unit Weight
In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	71 lbs.
47 5/8	23 5/8	47 11/32	23 11/32	45 3/8	21 3/8	
(1210)	(600)	(1215)	(606)	(1152)	(543)	



DIMENSIONS

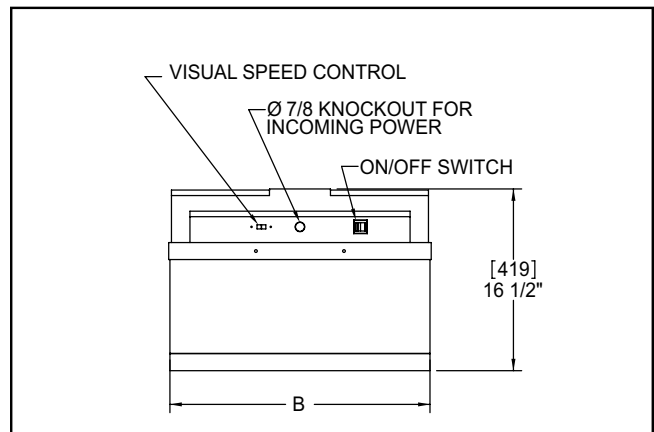
24X24 FFDER



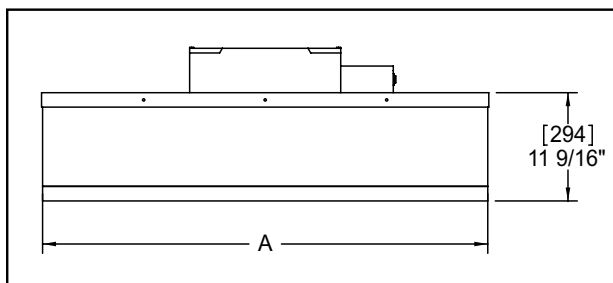
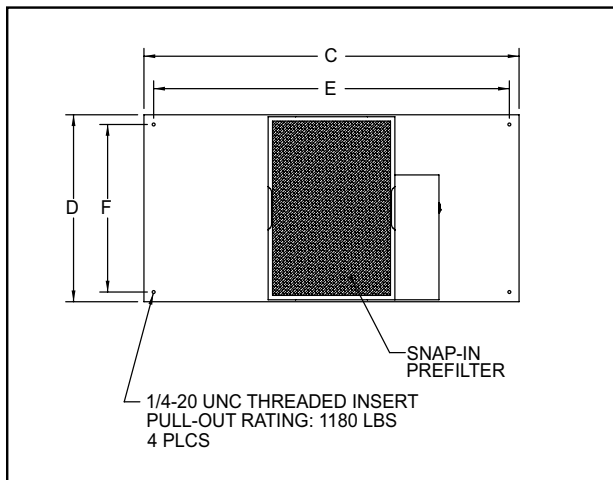
Critical Environment Diffusers

A	B	C	D	E	F	Unit Weight
In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	44 lbs.
23 5/8	23 5/8	23 11/32	23 11/32	21 3/8	21 3/8	
(600)	(600)	(606)	(606)	(543)	(543)	

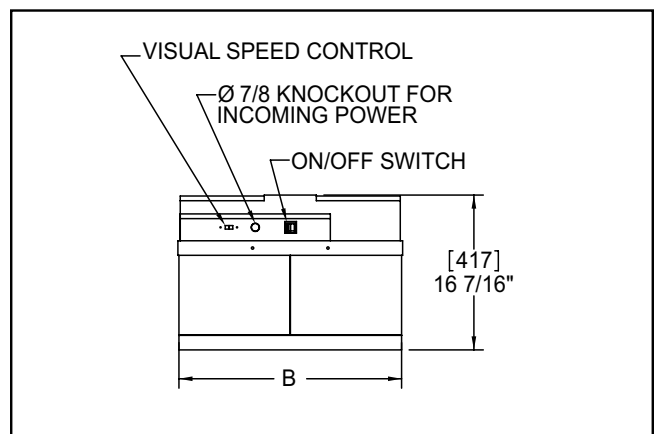
Note: The maximum inlet static pressure is 0.3 inches of water gauge. Operating above the maximum may adversely affect the performance of the unit and is not recommended.



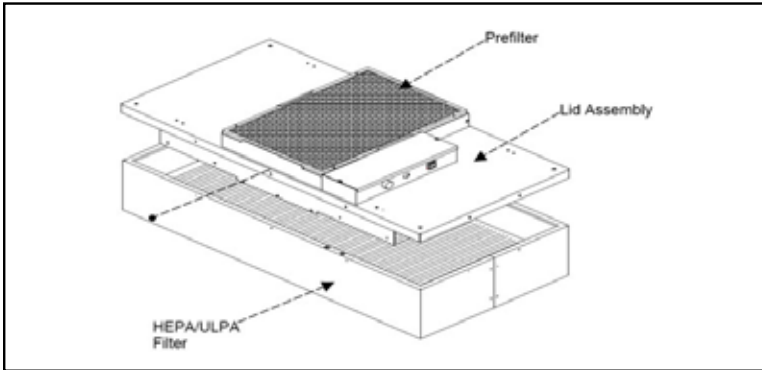
48X24 FFDER



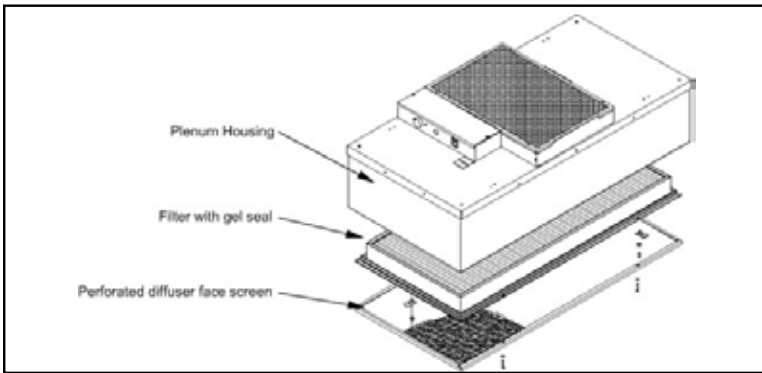
A	B	C	D	E	F	Unit Weight
In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	68 lbs
47 5/8	23 5/8	47 11/32	23 11/32	45 3/8	21 3/8	
(1210)	(600)	(1215)	(606)	(1152)	(543)	



FFD & FFDE



FFDR & FFDER

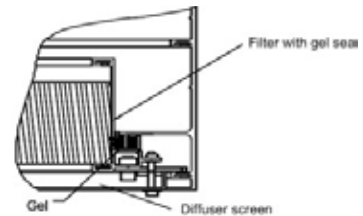


FILTER & GEL SEAL DETAIL: FFDR, FFDER

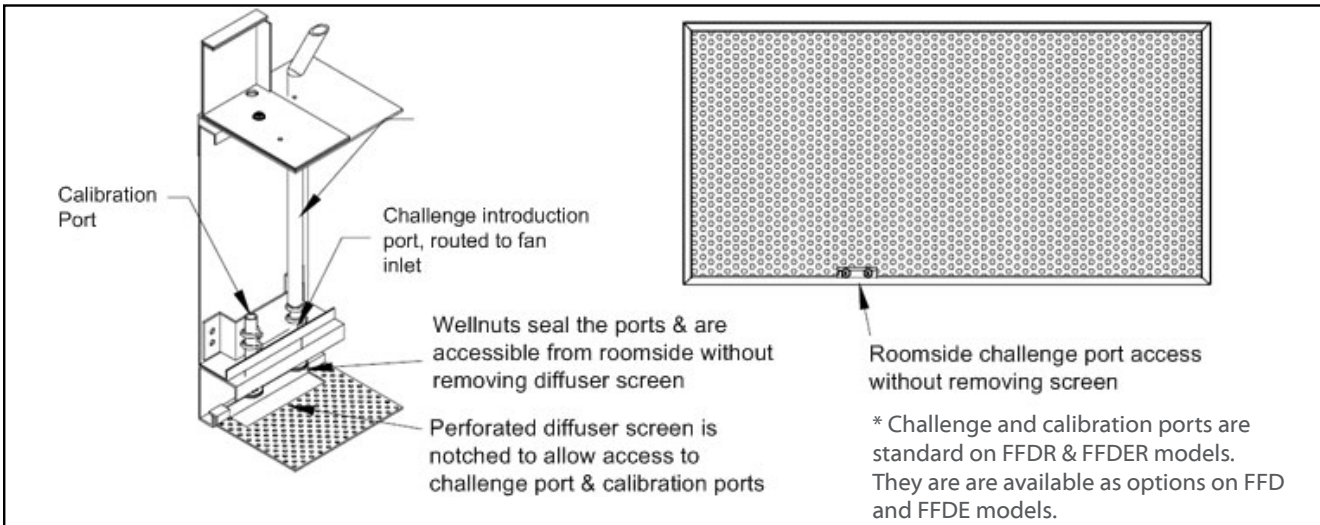
Lower housing is welded with full penetration welds providing a leak free mate to the gel seal filter. No caulk is required.



Diffuser screen is interference fit with housing, no hardware required.



CHALLENGE & COLLABORATION PORT DETAIL



* Challenge and calibration ports are standard on FFDR & FFDER models. They are available as options on FFD and FFDE models.

Model: FFD											
Nominal Size	Motor Hp	Voltage	Airflow/Power Consumption				Max Amps	Heat Gain (BTU/Hr) @ 90 FPM	Sound Level dBA	Active Filter Face Area (sq ft)	Unit Weight (lbs)
			@ Maximum airflow		@ 90 FPM						
			CFM	Watts	CFM	Watts					
24 x 24	1/5	120V	410	200	315	165	3.0	563	48.0	3.5	41
24 x 24	1/5	277V	410	200	315	165	1.2	563	48.0	3.5	41
48 x 24	1/5	120V	660	315	650	310	3.0	1058	51.0	7.2	66
48 x 24	1/5	277V	660	315	650	310	1.2	1058	51.0	7.2	66

Model: FFDR											
Nominal Size	Motor Hp	Voltage	Airflow/Power Consumption				Max Amps	Heat Gain (BTU/Hr) @ 90 FPM	Sound Level dBA	Active Filter Face Area (sq ft)	Unit Weight (lbs)
			@ Maximum airflow		@ 90 FPM						
			CFM	Watts	CFM	Watts					
24 x 24	1/5	120V	350	170	210	140	3.0	478	48.0	2.3	44
24 x 24	1/5	277V	350	170	210	140	1.2	478	48.0	2.3	44
48 x 24	1/5	120V	610	300	470	245	3.0	836	51.0	5.3	71
48 x 24	1/5	277V	610	300	470	245	1.2	836	51.0	5.3	71

Model: FFDE											
Nominal Size	Motor Hp	Voltage	Airflow/Power Consumption				Max Amps	Heat Gain (BTU/Hr) @ 90 FPM	Sound Level dBA	Active Filter Face Area (sq ft)	Unit Weight (lbs)
			@ Maximum airflow		@ 90 FPM						
			CFM	Watts	CFM	Watts					
24 x 24	1/3	120V	410	145	315	80	3.4	273	47.0	3.5	41
24 x 24	1/3	277V	410	145	315	80	1.7	273	47.0	3.5	41
48 x 24	1/3	120V	660	260	650	235	3.4	802	48.0	7.2	66
48 x 24	1/3	277V	660	260	650	235	1.7	802	48.0	7.2	66

Model: FFDER											
Nominal Size	Motor Hp	Voltage	Airflow/Power Consumption				Max Amps	Heat Gain (BTU/Hr) @ 90 FPM	Sound Level dBA	Active Filter Face Area (sq ft)	Unit Weight (lbs)
			@ Maximum airflow		@ 90 FPM						
			CFM	Watts	CFM	Watts					
24 x 24	1/3	120V	350	130	210	50	3.4	171	47.0	2.3	44
24 x 24	1/3	277V	350	130	210	50	1.7	171	47.0	2.3	44
48 x 24	1/3	120V	610	225	470	110	3.4	375	48.0	5.3	71
48 x 24	1/3	277V	610	225	470	110	1.7	375	48.0	5.3	71

Notes:

Airflow is tested in accordance with (ANSI/AMCA 210-07), (ANSI/ASHRAE 51-07) test standards for Certified Aerodynamic Performance Rating
 Max CFM rating based on free air volumes at high speed motor setting
 90 fpm values based on active face area
 Heat gain: BTU = watts x 3.413
 Max amps calculated using nominal power factor of 0.70

SUGGESTED SPECIFICATIONS

FAN FILTER DIFFUSERS

Fan Filter Diffusers shall be Titus models: FFD, FFDE, FFDR, FFDER for the sizes and mounting type as shown on the plans and outlet schedule. The diffuser shall be configured to deliver a filtered laminar airflow over the diffuser face. Standard construction shall include a patented baffle system as part of the fan plenum housing. Diffuser shall be UL507 listed with a UL Class 2 filter. Diffuser shall be furnished with a 30% (20PPI) polyurethane foam, washable prefilter (to be removed with round inlet option). Diffuser shall contain a HEPA filter that is factory tested and rated at 99.99% efficiency in removal of particles 0.3 microns and larger, and leak free in accordance with the latest I.E.S.T. recommended practices. Filter shall be auto scanned for efficiency and leakage prior to final assembly of the fan filter diffuser. Filter media shall be microglass fiber with hot melt separators, sealed to the aluminum housing. Diffuser shall contain a fan/motor assembly that is a direct drive, forward curve centrifugal type with permanently lubricated steel ball bearings. Bearings are rated for L-10 life of 80,000 hours.

Fan Filter Diffuser models: FFD, FFDR, shall have a permanent split capacitor type motor rated for continuous duty and furnished with thermal overload protection and Solid State Speed Control (SSSC). Diffuser models: FFDE, FFDER, shall have an electrically commutated motor (ECM)

MODEL NUMBER SPECIFICATION

Model	Duct Collar	Finish	Filter
FFD FFDE FFDR FFDER	0 (none) 10" 12"	01 Aluminum 04 Mill 26 White	HEPA ULPA PTFE
XXXXX	XX	XX	XXX
Module Size	Material	Voltage	Accessories
24 x 24 48 x 24	Aluminum AL	120V 120 240V 240 277V 277	Airflow Indicator Port AIL Challenge Port CHP Infared Speed Control ISC

* Challenge and calibration ports are standard on FFDR & FFDER models.

Critical Environment Diffusers

and digital visual speed control (VSD). Diffuser models: FFDR, FFDER shall have a removable face and room side access to integral HEPA filter.

Optional ULPA filters (rated at 99.9995% at 0.12 microns), and PTFE (Boron free) filters are available.

The plenum and filter housing shall have a #04 Mill finish. Optional powder coat paint or stainless steel exterior is available. Diffuser models: FFD, FFDE shall be constructed with an epoxy powder coated steel face.

Fan Filter Diffusers shall meet or exceed the requirements of the following industry standards: ISO Class 5(Class "100" (M 3.5)) air per the latest I.E.S.T. 14644-1 (Airborne Particulate Cleanliness Classes). I.E.S.T Recommended Practices (Laminar Flow Clean Air Devices). Averaged measured air velocity will be 90 ft/min (± 10 ft/min), when measured using a Velgrid (eight readings) at 6" below diffuser face. All measured values shall fall within $\pm 20\%$ of the measured average. The sound level shall be approximately 51 dBA (below NC 45) measured at 30" from diffuser face with an average airflow velocity of 90 ft/min. Noise measurements are taken with a clean filter and no external static pressure. Vibration level will not exceed .09 MILS RMS at 90 ft/min.

Accessories

Critical Environment Diffusers

HEPALERT

HEPA FILTER LED LIGHT KIT

Available Model:
HEPALERT

HEPALERT, HEPA Filter LED Light Kit for TLF and RadiaTec diffusers with HEPA filter

The HEPALERT LED light kit automatically monitors filter loading using differential pressure sensors and LED status lights.

- LED lights illuminate from green to red when the pressure set point for filter replacement has been reached (A green light indicates the filter continues to clean, while a red light indicates the filter needs to be replaced).

- HEPALERT is designed for Titus TLF and RadiaTec diffusers with HEPA filters.
- LED kit eliminates need to remove diffuser face to visually check filter cleanliness.
- LEDs are visible from occupied area.
- HEPALERT switch (field calibrated) activates LED when filter-free area becomes fifty percent restricted. Instructions are included for field calibration.
- Kit is shipped loose and requires field installation.

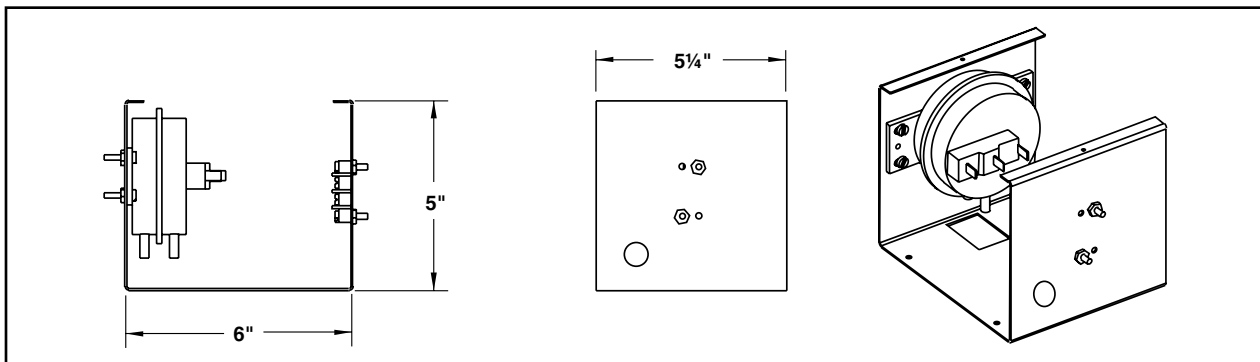
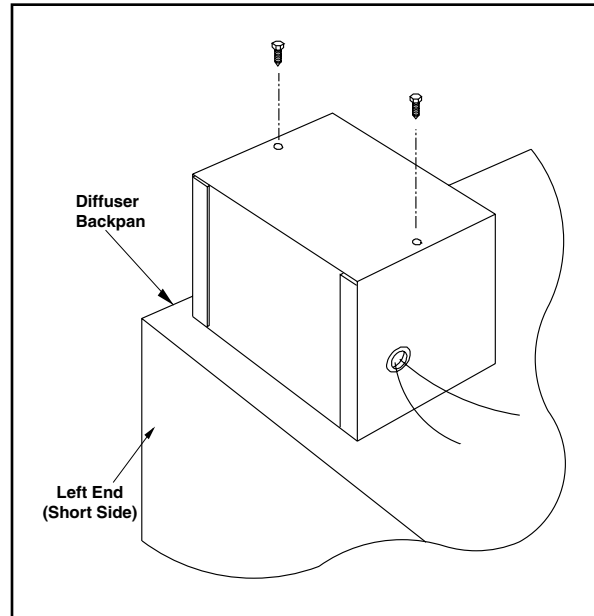
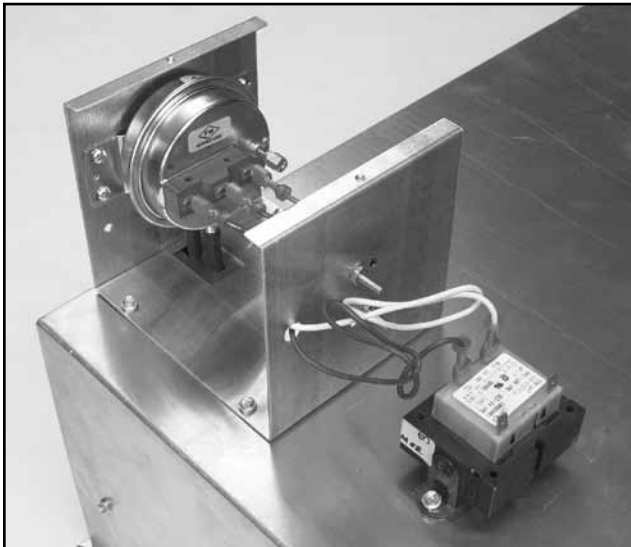


HEPALERT

- 24 VAC transformer required (supplied by others).
- Filter operation is unaffected by room pressure changes.

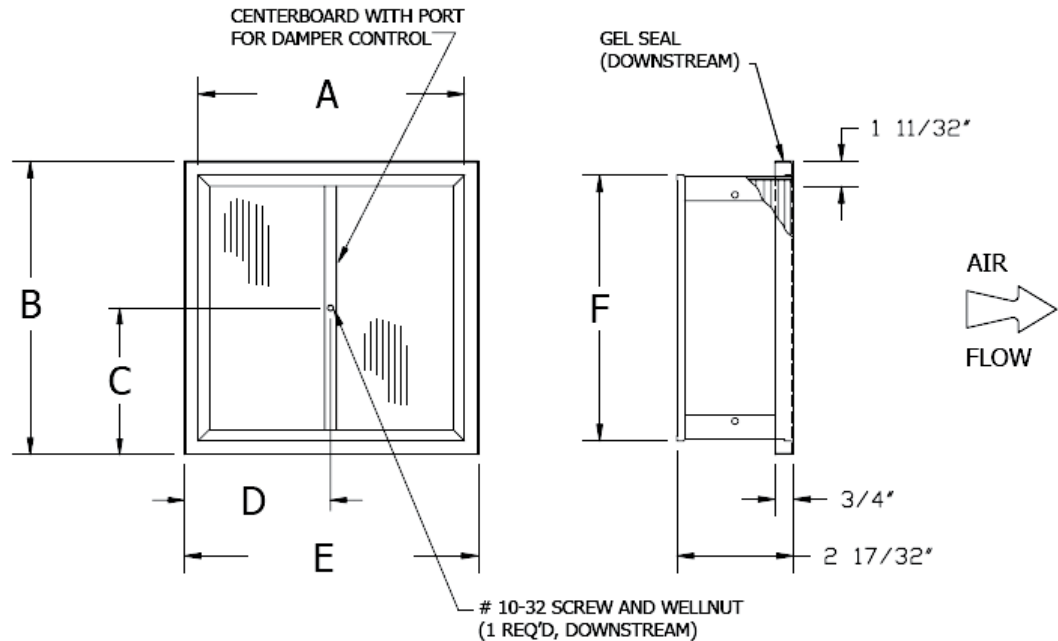
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HEPALERT

HEPA FILTER



Filter Part Number	Nominal Size	A	B	C	D	E	F	Effective Face Area (Sq ft)
HF2412T	24 X 12	16-3/4	6-1/8	3-1/16	9-1/16	18-1/8	4-3/4	0.37
HF3612T	36 X 12	28-3/4	6-1/8	3-1/16	15-1/16	30-1/8	4-3/4	0.66
HF4812T	48 x 12	40-3/4	6-1/8	3-1/16	21-1/16	42-1/8	4-3/4	0.94
HF6012T	60 x 12	52-3/4	6-1/8	3-1/16	27-1/16	54-1/8	4-3/4	1.23
HF7212T	72 x 12	64-3/4	6-1/8	3-1/16	33-1/16	66-1/8	4-3/4	1.52
HF2424T	24 x 24	16-3/4	18-1/8	9-1/16	9-1/16	18-1/8	16-3/4	1.66
HF3624T	36 x 24	28-3/4	18-1/8	9-1/16	15-1/16	30-1/8	16-3/4	2.94
HF4824T	48 x 24	40-3/4	18-1/8	9-1/16	21-1/16	42-1/8	16-3/4	4.23
HF6024T	60 x 24	52-3/4	18-1/8	9-1/16	27-1/16	54-1/8	16-3/4	5.52
HF7224T	72 x 24	64-3/4	18-1/8	9-1/16	33-1/16	66-1/8	16-3/4	6.81
HF4836T	48 x 36	40-3/4	30-1/8	15-1/16	21-1/16	42-1/8	28-3/4	7.52
HF6036T	60 x 36	52-3/4	30-1/8	15-1/16	27-1/16	54-1/8	28-3/4	9.81
HF7236T	72 x 36	64-3/4	30-1/8	15-1/16	33-1/16	66-1/8	28-3/4	12.09

FILTER SPECIFICATIONS

- Titus HEPA filters are designed specifically to fit the Titus TLF and RadiaTec diffusers manufactured after 6/10/07. These filters will not fit diffusers manufactured before that date.
- Filter efficiency is 99.99% with 0.3 micron particles per standard: IES-RP-CC-001.3 (Institute of Environmental Science & Technology).
- The filter resistance to airflow will be a maximum of 0.52" water gauge at 100 fpm. Refer to chart on page R48 for additional pressure drop values.
- Filter is scan tested for leaks at an air flow of 100 fpm.
- Frame material is extruded anodized aluminum.
- Filter has a downstream gel seal to mate with diffuser HEPA knife edge. Gel seal material is Blu-Jel.
- Filter media is 007 Dimple-pleat (ME-D0700). Pack style is 2" dimple pleat.
- Filter is constructed of fire-rated materials per standard: UL-900 class 1.
- Filter has a centerboard with (1) port for damper operation. Cadmium plated screw (included with filter) must be inserted into port while filter is in use.
- The filter maximum operating temperature is 250°F, and the maximum relative humidity (R.H.) is 100%.
- Filters are non-hygroscopic.

Nominal Filter Size										
24 x 12	CFM	6	7	11	15	19	22	30	37	44
	Pressure	0.080	0.11	0.15	0.21	0.26	0.32	0.42	0.53	0.68
36 x 12	CFM	10	13	20	26	33	40	53	66	79
	Pressure	0.08	0.11	0.15	0.21	0.26	0.33	0.43	0.54	0.69
48 x 12	CFM	14	19	28	38	47	56	75	94	113
	Pressure	0.07	0.09	0.14	0.19	0.29	0.36	0.42	0.60	0.68
60 x 12	CFM	18	25	37	49	62	74	98	123	148
	Pressure	0.08	0.11	0.15	0.21	0.27	0.33	0.44	0.54	0.70
72 x 12	CFM	23	30	46	61	76	91	122	152	182
	Pressure	0.07	0.09	0.14	0.19	0.25	0.30	0.42	0.52	0.66
24 x 24	CFM	25	33	50	66	83	100	133	166	200
	Pressure	0.07	0.09	0.14	0.19	0.25	0.30	0.42	0.52	0.66
36 x 24	CFM	44	59	88	118	147	176	235	295	353
	Pressure	0.07	0.09	0.14	0.19	0.25	0.30	0.42	0.52	0.66
48 x 24	CFM	63	85	127	170	212	254	338	423	508
	Pressure	0.07	0.10	0.14	0.20	0.25	0.30	0.42	0.52	0.66
60 x 24	CFM	83	110	166	221	276	331	442	552	663
	Pressure	0.07	0.10	0.14	0.20	0.25	0.31	0.42	0.52	0.66
72 x 24	CFM	102	136	204	272	340	409	545	681	817
	Pressure	0.08	0.10	0.14	0.20	0.25	0.31	0.42	0.52	0.66
48 x 36	CFM	113	150	226	301	376	451	601	752	902
	Pressure	0.08	0.10	0.15	0.21	0.26	0.31	0.42	0.52	0.66
60 x 36	CFM	147	196	294	392	490	589	785	981	1177
	Pressure	0.08	0.11	0.15	0.21	0.26	0.31	0.42	0.53	0.67
72 x 36	CFM	181	242	363	484	605	725	967	1210	1450
	Pressure	0.08	0.11	0.15	0.21	0.26	0.31	0.42	0.53	0.67

- Pressure loss values listed above are measured in inches of water gauge (w.g.)
- Pressure loss value is for an unused filter only. This value must be added to the diffuser pressure drop to determine total pressure.

Application Notes

TITUS OPERATING ROOM AIR DISTRIBUTION SYSTEM

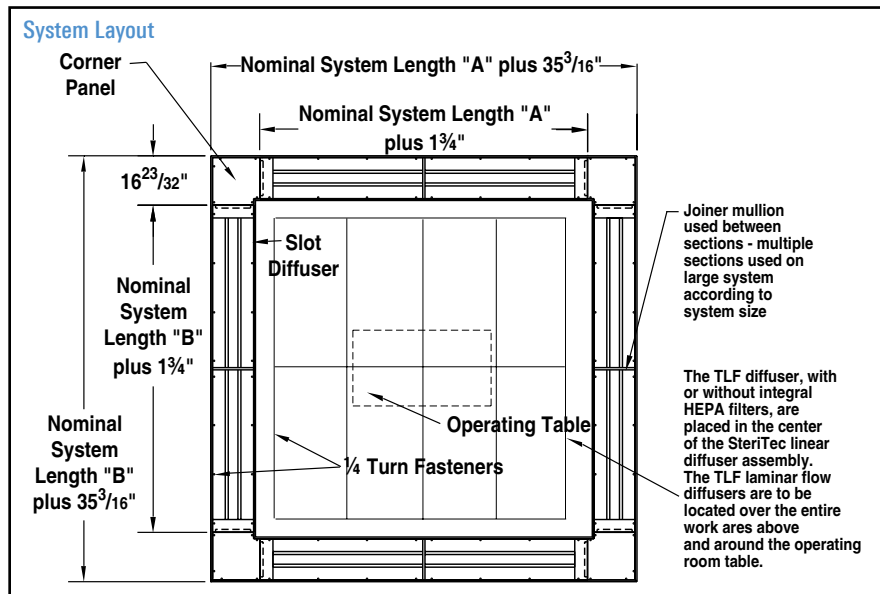
SYSTEM SIZING AND LAYOUT

SYSTEM CALCULATIONS STEPS

1. Determine room size.
2. Determine desired number of air changes with a minimum of 4 outdoor air changes per hour for the SteriTec perimeter air curtain and the TLF internal diffusers.
3. Determine SteriTec nominal system size.
4. Determine desired total system cfm.
5. Determine perimeter air curtain cfm.
6. Determine internal diffuser cfm (usually 50 to 75 percent of the total cfm).
7. Select number of inlets and the location from the chart shown.
8. Determine number TLF units and inlet size for each unit.

New ASHRAE guidelines point to providing continuous pillar of laminar airflow air distribution over the operating table and personnel as well the surgical instrument table. These guidelines indicate the laminar airflow velocity should not exceed 25-35 fpm at the patient. The reason is the laminar flow should not overcome the natural plume of airflow from the body and allow the laminar flow to drive contaminants in a wound. New data has now been shown that space inside the "sterile field" can be used for lighting, gas connections, etc. This data shows that up to 30% of the

primary supply diffuser array area may be allocated for non-diffuser use such as lights, gas columns, etc. but caution is advised. The air curtain, or air wall, is recommended around the sterile field to stop contamination from entrainment along the ceiling line and along the outer perimeter of the airflow coming down from the TLF supply diffusers. (See page R31 for more details.) Most operating rooms are now recommended to be designed at a minimum 20 air changes per hour (ACPH). The new guidelines do not state a minimum. The airflow should be HEPA filtered and the operating room is normally at a positively pressure. Most codes call for the return grilles to be located at the external lower wall areas above the floor level in the corners of the room. For critical operating rooms a LineaTec air curtain should be added. The air curtain provides an air wall outside the laminar airflow zone to decrease entrainment or induction into the laminar airflow perimeter. The air curtain is normally selected for a terminal velocity of 50 fpm at 2 feet. above the floor. The Titus LineaTec diffuser has a deflector that can be adjusted to deflect the air stream inward or slightly outward.



The operating room system specifications table provides SteriTec and TLF specifications based on different combinations of ACPH and room dimensions. Rectangular sizes can also be used.

Air Changes Per Hour	Ceiling Height (ft.)	Room Dim. (ft.)	SteriTec Specifications							TLF Specifications					System Total cfm	
			Dim. (ft.) A + B	Active Slots	System Layout*	Max Inlet Size (in.)	Inlets Required	Plenum Inlet Locations*	Total cfm	Throw (ft.) @ 50 fpm @ 2' A.F.	No. of units	Dim. (in.)	Inlet Size (in.)	Total cfm		Throw to 30 fpm
20	10	30 x 38	12 x 12	2	A	60 x 8	4	2, 4, 6, 8	1,920	8	8	24 x 48	12	1,920	7	3,840
25	10	30 x 31	12 x 12	2	A	60 x 8	4	2, 4, 6, 8	1,920	8	8	24 x 48	12	1,920	7	3,840
30	10	28 x 27.5	12 x 12	2	A	60 x 8	4	2, 4, 6, 8	1,920	8	8	24 x 48	12	1,920	7	3,840
35	10	27 x 26	12 x 12	2	A	60 x 8	4	2, 4, 6, 8	1,920	8	8	24 x 48	12	1,920	7	3,840
20	10	44 x 45	14 x 14	2	B	42 x 8	8	1, 3, 4, 6, 7, 9, 10, 12	2,240	8	18	24 x 48	10	4,320	7	6,560
25	10	39 x 40	14 x 14	2	B	42 x 8	8	1, 3, 4, 6, 7, 9, 10, 12	2,240	8	18	24 x 48	10	4,320	7	6,560
30	10	36 x 37	14 x 14	2	B	42 x 8	8	1, 3, 4, 6, 7, 9, 10, 12	2,240	8	18	24 x 48	10	4,320	7	6,560
35	10	33 x 34	14 x 14	2	B	42 x 8	8	1, 3, 4, 6, 7, 9, 10, 12	2,240	8	18	24 x 48	10	4,320	7	6,560

*Refer to page R36 for Plenum Inlet Location diagrams.

**cfm for 30 fpm see R29

A.F. = Above Floor

Required System Information

- Room Volume _____ ft³.
- Air Change per Hour _____.
- SteriTec Dimensions _____' x _____'.
- System Total cfm _____.
- SteriTec Total cfm _____.
- Number of TLF diffusers _____.
- cfm per TLF diffuser _____.

OPERATING ROOM AIR DISTRIBUTION SYSTEM

The discussion presented in the application notes are intended as aids to heating and air conditioning engineers and designers with skill and knowledge about clean room design. Titus has no control over the system design and application of these critical environment products, a function that rightfully belongs to the designer.

Contaminated air outside the air curtain is prevented from entering the clean zone by the air curtain. Contaminated air in the clean zone is pushed down and outward by the laminar flow on the interior of the clean zone.

The interior of the system should have the highest room pressure due to velocities and air volume from the air diffusers.

Velocities should be kept to a maximum of 35 fpm at operating table height so the natural plumage velocity of the patient is not over powered and helps to prevent contaminants from getting into open wounds during surgery. The laminar flow diffuser should have quarter-turn fasteners and all internal parts shall be removable for cleaning and sterilization.

The entire operating room is usually under positive pressure created by dampering exhaust air and by providing extra makeup air. This helps to prevent an ingress of contaminated particles from outside the clean room. As doors or dividers are opened or parted, the positive internal pressure causes air to flow toward the lower external pressure outside the clean environment. The outward airflow forces particles away from the interior zone. Some hospital rooms are designed for negative pressure to keep contaminants from contaminating other hospital areas and endangering other people.

Plenums for LineaTec diffusers used in operating rooms usually have radiused corners. Corners are radiused with a $\frac{3}{4}$ -inch radius to facilitate cleaning and to avoid areas where microorganisms can grow, later contaminating incoming clean air. The face of the LineaTec can be removed by rotating quarter-turn fasteners.

Critical Environment Diffusers

The entire plenum is then exposed to the maintenance worker. The plenum system is usually interconnected so a minimum number of inlets can be utilized for incoming air from the air handler.

Corner transitions are utilized so the plenum can be continuous, even at the corners. Corner transitions found on Titus plenum systems are covered on the operating room side by a cover plate. When the plate is removed, the entire plenum corner is exposed for easy cleaning. The cover plate itself can be put in an autoclave for sterilization. Some competitive models utilize an elbow behind the ceiling as corner transitions. To clean the corner transitions, the maintenance worker must reach around the corner in areas that are hidden from sight; this is not recommended.

The operating room design engineer determines the number of ACPH based on the cleanliness level desired and current industry standards. Plenum inlets are sized so the maximum inlet velocity is in the 500 fpm range. Inlets can be lengthened and made longer to reduce entrance velocities or multiple inlets can be used. Plenum velocities should be kept as low as possible to facilitate automatic balancing of the air curtain. The 800 fpm range is considered top end, 400 to 500 fpm is desirable.

Total room airflow should be divided between the perimeter air curtain and the center diffusers. The perimeter air curtain should be supplying air between 25 to 50 cfm per foot. HEPA filters should be located remotely.

The standard material of construction is 304 stainless steel. The 304 stainless steel offers durability and an attractive appearance; plus it can withstand manual sterilization using harsh chemicals normally encountered for this purpose. The standard finish is #04 mill finish.

Manual balancing dampers should be sufficient to allow balancing of individual duct branches. Design flow rates to the interior clean zone should be established through normal balancing procedure by a certified air balancing professional. The perimeter zone should be adjusted to obtain the required cfm per foot as designed.



Basic Cleanroom Terminology

CLEAN AREA

A defined area within a clean room designed for environmentally controlling airborne particulates, temperature, humidity, air pressure, airflow patterns, air motion, vibration, noise, viable organisms, and lighting.

CLEANLINESS CLASSIFICATION (CLASS)

Number of particles per cubic foot based on the requirements outlined in Federal Standard 209. See the following graph. For example, the ASHRAE 1999 Applications Handbook defines a Class 10,000 clean room as a clean room where the particle count does not exceed 10,000 particles per cubic foot of a size 0.5 micrometers and larger, or 65 particles per cubic foot of a size 5.0 micrometers and larger.

CLEANROOM

An enclosed area especially constructed for environmentally controlling airborne particulates, temperature, humidity, air pressure, airflow patterns, air motion, vibration, noise, viable organisms, and lighting.

FIRST AIR

The air that issues directly from the HEPA filter before it passes over any work location (ASHRAE 1991 Applications Handbook).

HIGH-EFFICIENCY FILTER (HEPA)

A filter with an efficiency in excess of 99.97% of 0.3 micrometer particles, as determined by DOP test (ASHRAE 1999 Applications Handbook).

Critical Environment Diffusers

LAMINAR FLOW CLEANROOM

A clean room with airflow in nominally one direction (ASHRAE 1999 Applications Handbook).

MAKEUP AIR

Air introduced to the secondary (recirculated) air system for ventilation, pressurization and replacement of exhaust air.

PARTICLE CONCENTRATION

The number of individual particles per unit volume of air (ASHRAE 1999 Applications Handbook).

PARTICLE SIZE

The maximum linear dimension of a particle expressed in micrometers (10⁻⁶ meters).

SECONDARY AIR

Air that recirculates through the workspace (ASHRAE 1999 Applications Handbook).

PRIMARY AIR

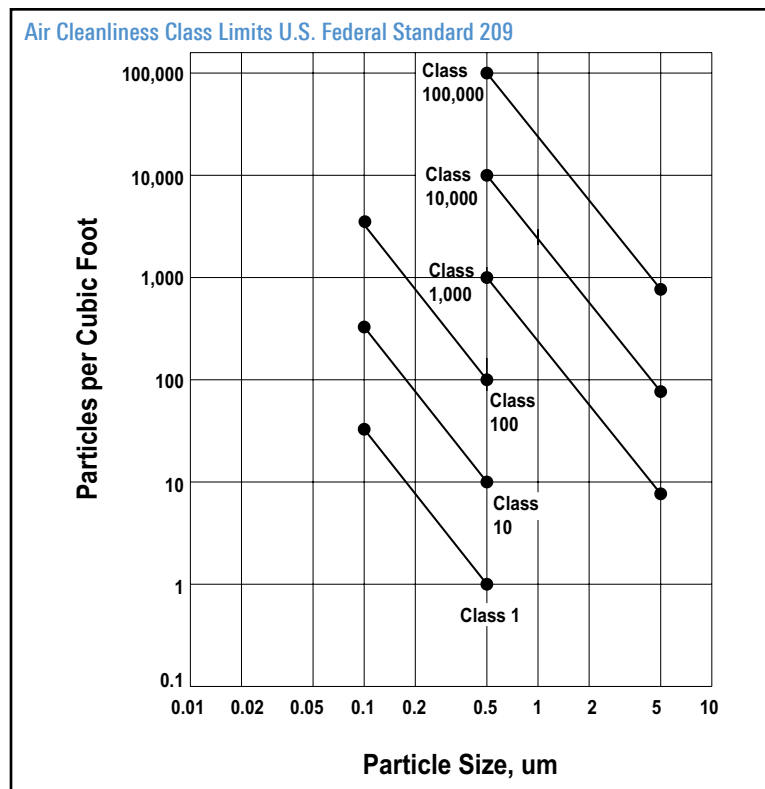
Portion of primary air circulated through the air conditioning equipment.

ULTRA LOW PARTICULATE AIR FILTER (ULPA)

A filter with a minimum efficiency of 99.999 percent of 0.12 micrometer particles, as determined by DOP test (ASHRAE 1999 Applications Handbook).

WORK AREA

A defined area environmentally controlled and designed for specific tasks.

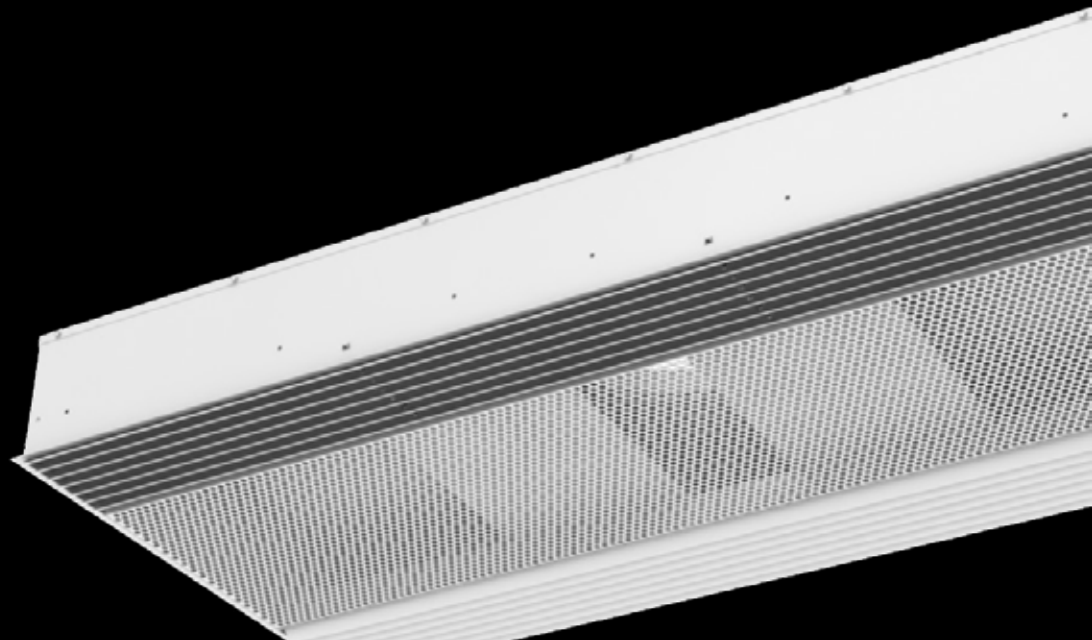




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www.titus-hvac.com | www.titus-energy-solutions.com











605 Shiloh Rd
Plano TX 75134
main - 972.212.4800
fax - 972.212.4884