



critical environment diffusers



Titus
The Leader in Air Management

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Critical Environment Diffusers Overview ●●●

Applications

Titus representatives have installed diffusers in clean rooms and in clean areas throughout the entire country for over 20 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 Clean Room 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.

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.

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.



Sterile Environment Diffusers



Short-Throw Diffusers with Exhaust Hoods

Critical Environment Diffusers | Applications

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APPLICATIONS

Applications • Air Motion (continued)

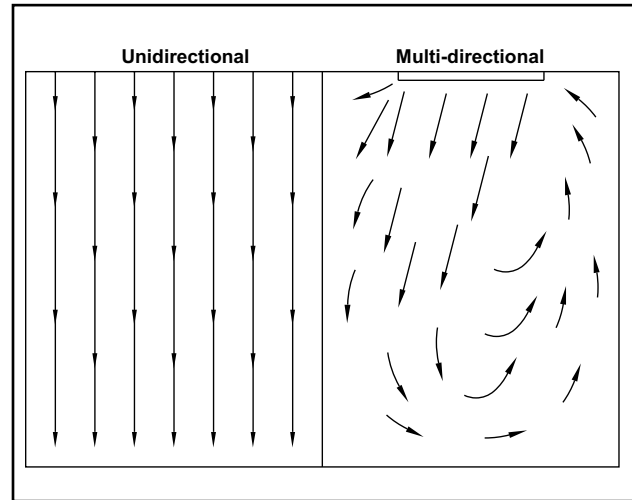
Laminar flow can be used to provide clean airflow over an obstruction and push particles to a floor return plenum. Return grilles can be located in the floor of the room and can be exhausted as shown in the figure, Laminar Flow. In many cases, however, codes require the return air grille to be mounted in the lower side-wall of the room. This allows the floors to be mopped and cleaned for standard conditions.

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 on the previous page. Typical hood capture velocities are about 100 fpm.

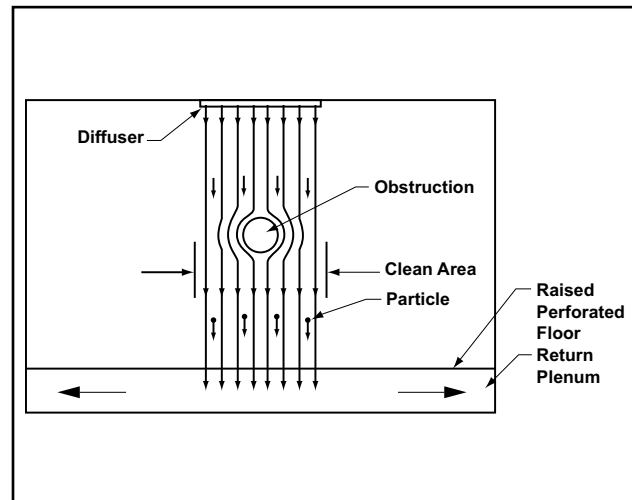
Whether unidirectional or multi-directional airflow patterns are utilized, air velocities in the clean area must be controlled. Particles 0.5 micrometers and larger tend to quickly settle on the floor or other work surfaces due to gravity. These particles are easily disturbed and re-entrained into the 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.



Typical Airflow Patterns in Clean Room



Laminar Flow (Class I - 1000)

Critical Environment Diffusers | Applications

Applications (continued)

Filter Designation and Efficiency Level

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

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.

VersaTec ●●●

Hemispherical Air Diffusion Using Adjustable Blades

Models:

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

These Products Include

- 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.
- 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.
- Aluminum face and backpan.

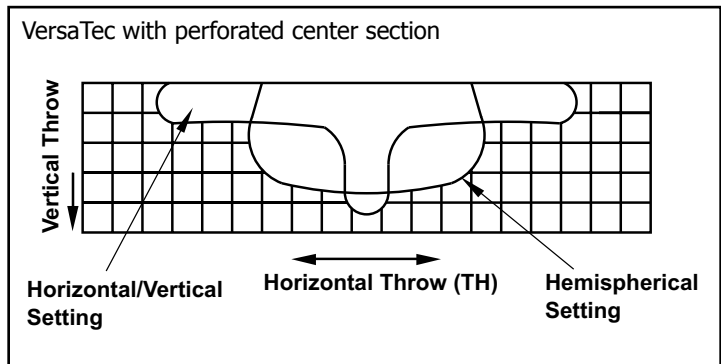
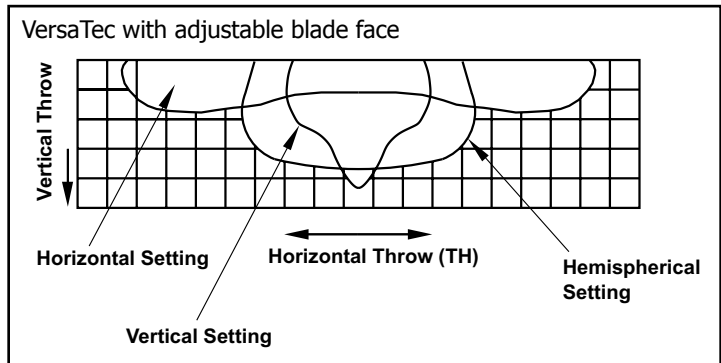


VersaTec Installation in Chemistry Lab

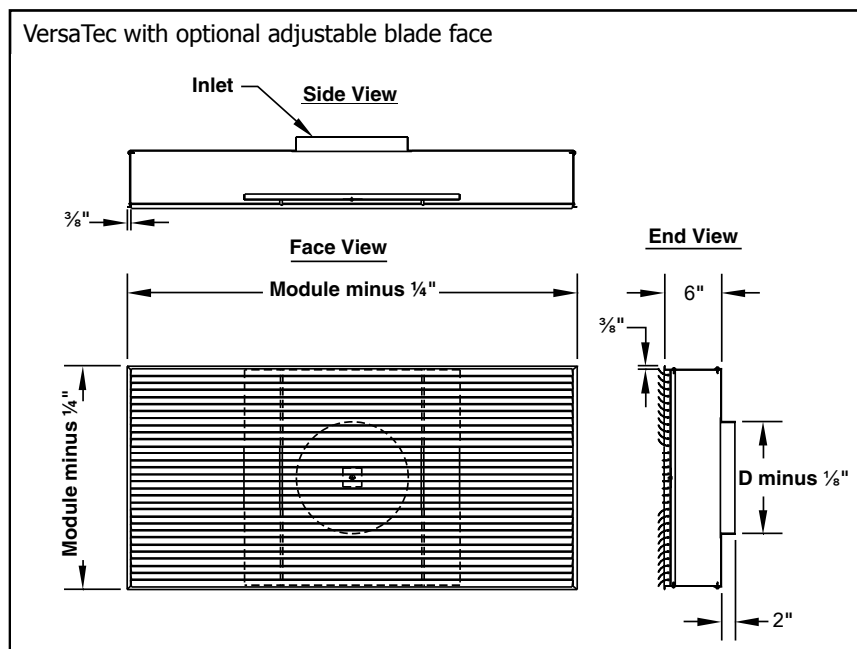
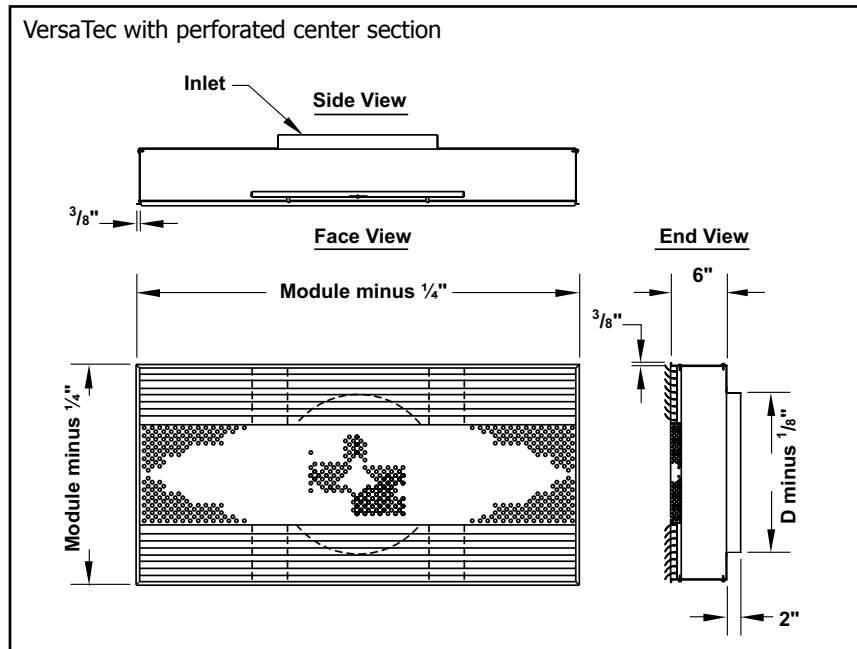
Overview

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.



Dimensions



Critical Environment Diffusers | VersaTec | Performance Data

Performance Data
VersaTec and VersaTec-AL

PERFORMANCE DATA

		Discharge Pattern						
		Hemispherical			Horizontal			
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° FΔT	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° FΔT	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° FΔT	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° FΔT	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.
- 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.

Critical Environment Diffusers | VersaTec | Specifications

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.

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 Standards 70-2006 and 113.

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"		2-Way		2	Perforated Center Straight Blade		
24 x 24 Module 10"					P S		

Critical Environment Diffusers | TriTec | Description

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TRITEC

TriTec ●●●

High Volume, Low Velocity, Radial Air Diffusion Technology

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.

These Products Include

- Standard Finish #26 White.
- Optional Finish #04 Mill.
- Face drops no more than 5/8-inch below the ceiling.

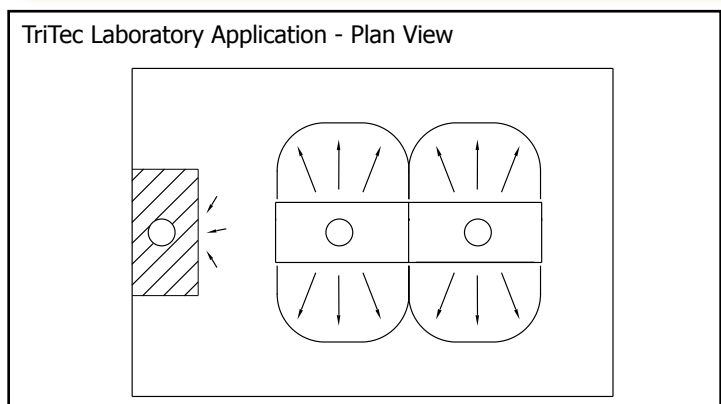
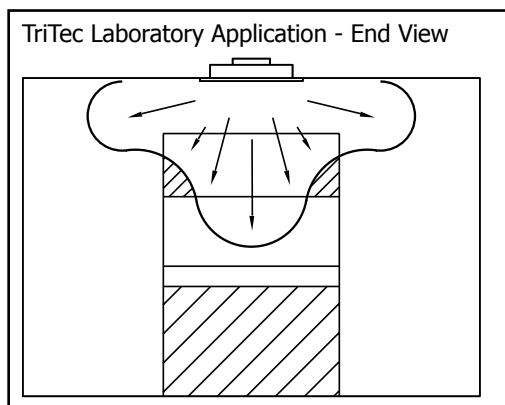
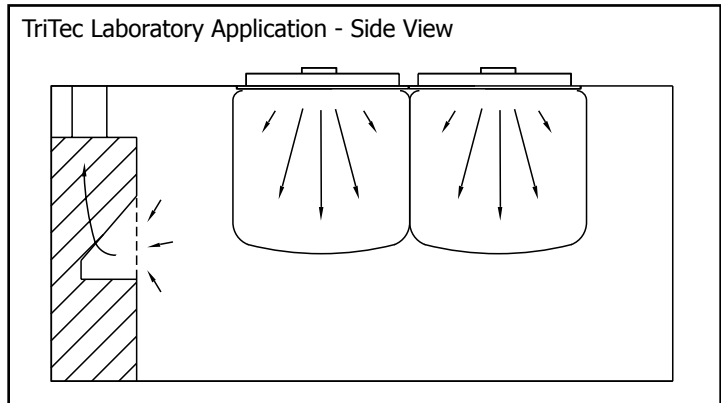
- Removable face for sanitizing (no special tool required to remove the face).
- Available in steel, 304 stainless steel, or aluminum with 304 stainless steel face.
- Available in 24 x 24-inch and 48 x 24-inch module sizes.
- Low velocity hemispherical pattern or one-way hemispherical pattern available.
- 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



Critical Environment Diffusers | TriTec | 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 5/8-inch. In appearance, TriTec models look like industry standard perforated diffusers.

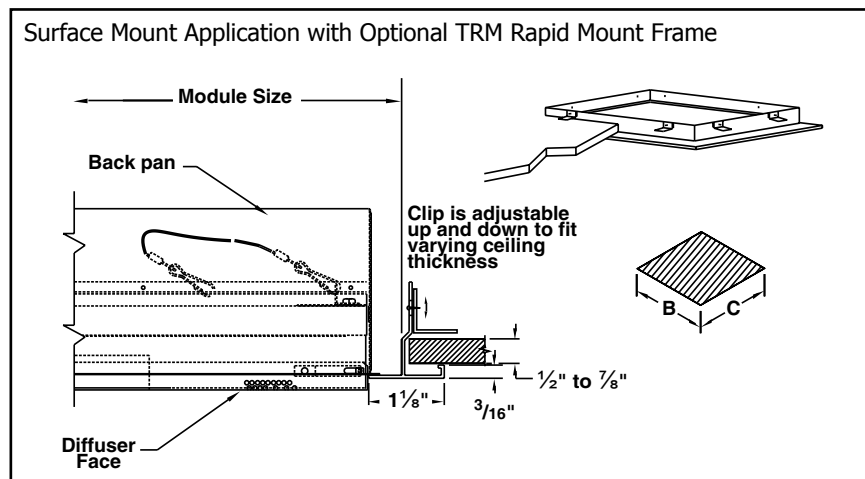
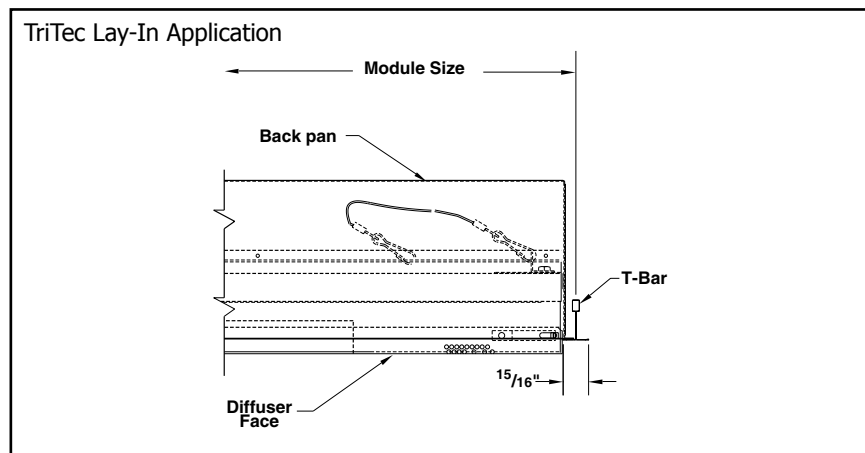
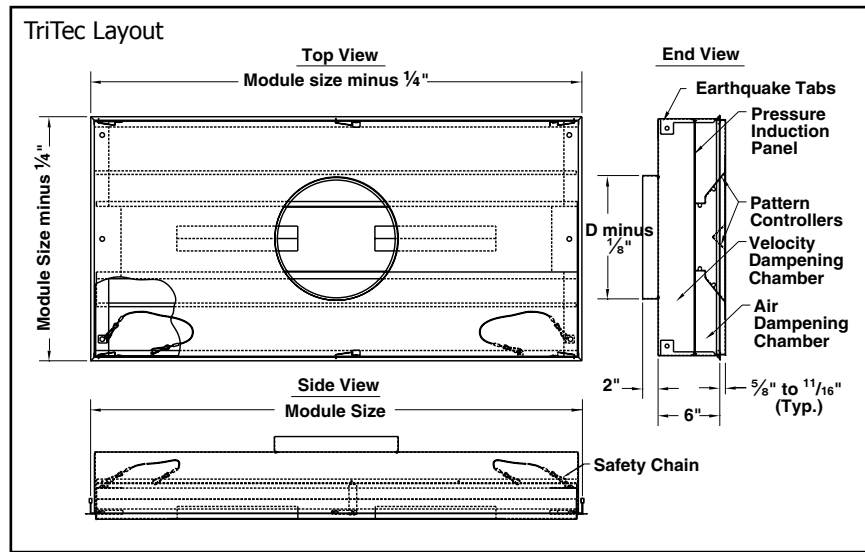
TriTec's unique design allows it to create a full pattern in the middle of the diffuser as well as on the ends. The design of the TriTec allows these diffusers to be mounted end to end without increasing the throw.

Applications include labs with exhaust fans, 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 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 | Performance Data

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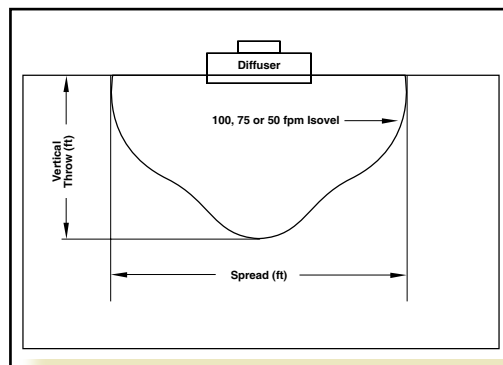
PERFORMANCE DATA

Performance Data

TriTec, TriTec-AL and TriTec-SS

Module Size and Inlet Size	2-Way Pattern				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				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, 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.



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 ³/₁₆-inch diameter holes on ¼-inch staggered centers, and shall match the appearance of industry standard perforated diffusers. The face shall not hang below the ceiling more than 5/8 inches and shall have 6 clips securing it in place.

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 ½ radial air diffusion (one-way).

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 Standards 70-2006 and 113.

TriTec-AL

Use TriTec specification and make the following changes:

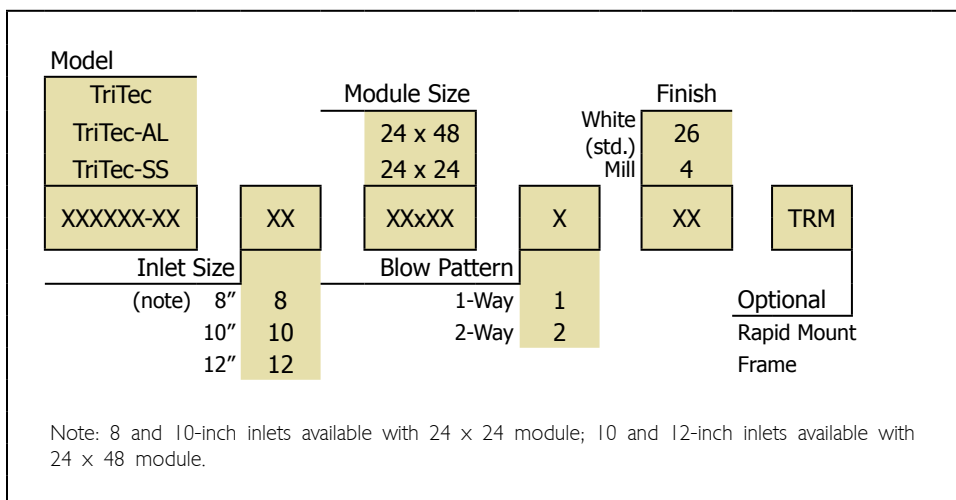
- Change the model number to TriTec-AL.
- Change the reference of steel to aluminum for the backpan.
- Change the reference of steel to 304 stainless steel for the face.

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



TLF ●●●

Vertical Laminar Flow Technology

Models:

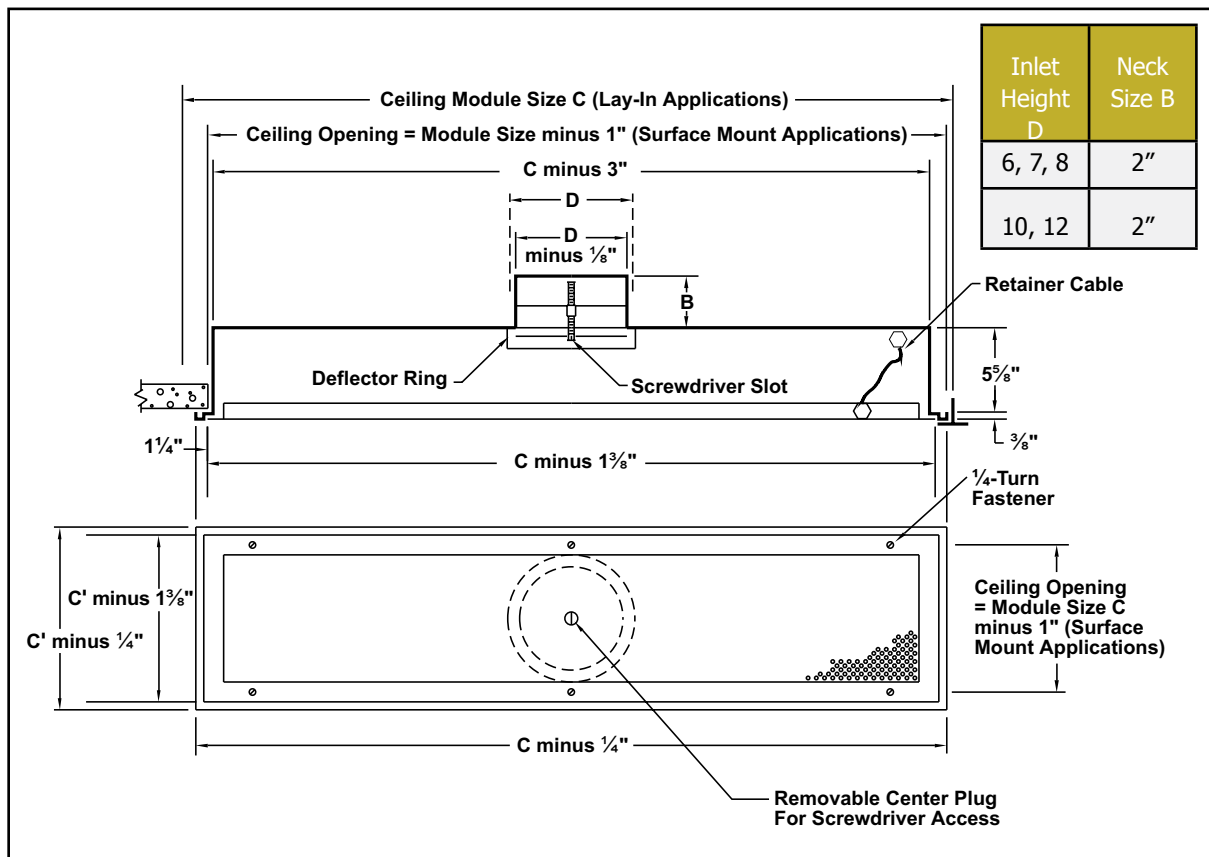
- TLF
 - Steel
- TLF-AA
 - Aluminum
- TLF-SS
 - 304 Stainless Steel

These Products Include

- 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.
- 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.



Critical Environment Diffusers | TLF | Description

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.

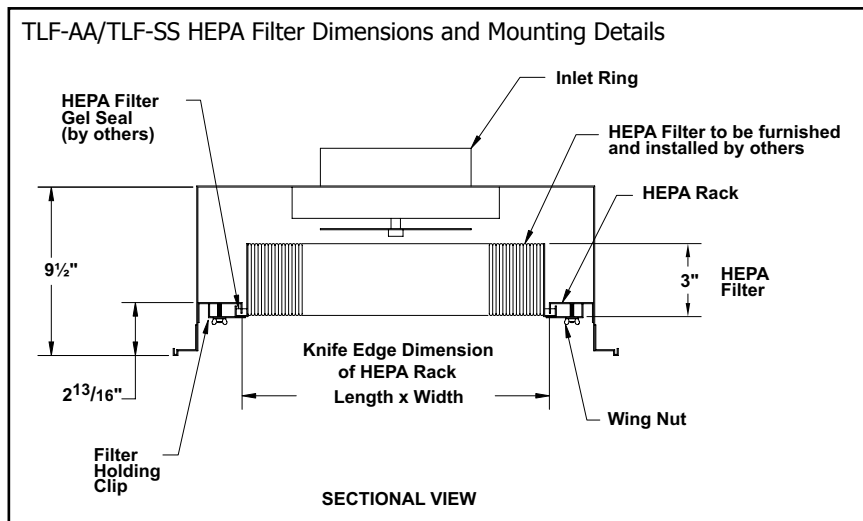
The TLF Series of laminar flow diffusers generates a low velocity, evenly distributed, downward moving "piston" of conditioned air.

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.

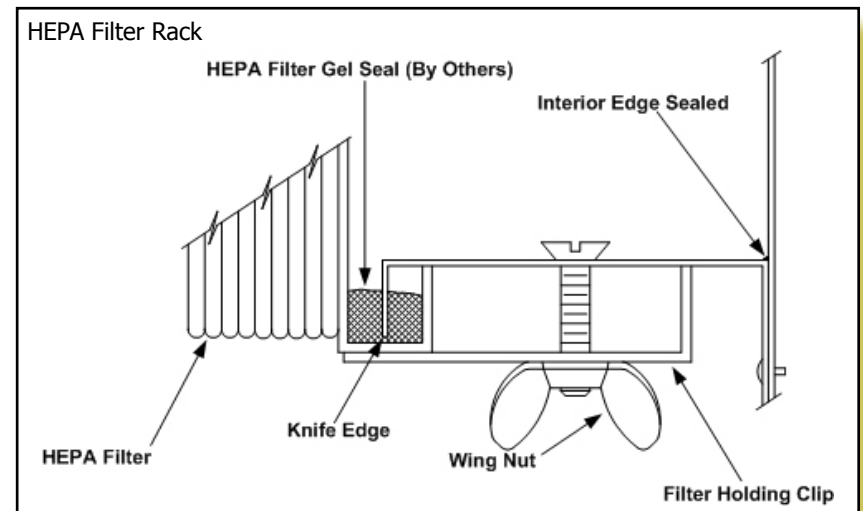
TLF is especially effective in cooling areas with heavy, localized, internal loads, as in computer rooms. The column of air delivered by the TLF cools the load source directly without generating high velocities in the occupied space.

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 rack 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.



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



TLF

Critical Environment Diffusers | TLF | Performance Data

Performance Data

TLF, TLF-AA and TLF-SS

PERFORMANCE DATA

7" Round Neck	Airflow, cfm	100	120	140	160	180	220	240	260	300
48" x 12" Face	Total Pressure	0.042	0.060	0.082	0.110	0.135	0.200	0.240	0.280	0.370
	NC (Noise Criteria)	11	17	22	26	29	35	38	41	45
	Vert. Projection	1-2-3	1-3-4	2-4-5	2-4-6	3-5-7	4-7-8	5-7-9	6-8-10	6-9-11
60" x 12" Face	Total Pressure	0.039	0.056	0.076	0.100	0.125	0.195	0.223	0.260	0.348
	NC (Noise Criteria)	-	16	21	25	28	34	37	40	44
	Vert. Projection	1-2-3	1-3-4	2-4-5	2-4-6	3-5-7	4-7-8	5-7-9	6-8-10	6-9-10
72" x 12" Face	Total Pressure	0.036	0.053	0.071	0.094	0.116	0.180	0.210	0.245	0.320
	NC (Noise Criteria)	-	15	20	24	27	33	36	39	43
	Vert. Projection	1-2-3	1-3-4	2-4-5	2-4-6	3-5-7	4-7-8	5-7-9	6-8-10	6-9-10
7" Round Neck	Airflow, cfm	100	120	140	160	180	220	240	260	300
24" x 24" Face	Total Pressure	0.042	0.060	0.082	0.110	0.135	0.200	0.240	0.280	0.370
	NC (Noise Criteria)	11	17	22	26	29	35	38	41	45
	Vert. Projection	1-2-3	1-3-4	2-4-5	2-4-6	3-5-7	4-7-8	5-7-9	6-8-10	6-9-12
36" x 24" Face	Total Pressure	0.036	0.053	0.071	0.094	0.116	0.180	0.210	0.245	0.320
	NC (Noise Criteria)	-	16	21	25	28	34	37	40	44
	Vert. Projection	1-2-3	1-3-4	2-4-5	2-4-6	3-5-7	3-6-8	4-6-9	5-7-10	5-8-10
48" x 24" Face	Total Pressure	0.033	0.047	0.065	0.087	0.107	0.160	0.190	0.223	0.290
	NC (Noise Criteria)	-	15	20	24	27	33	36	39	43
	Vert. Projection	1-1-3	1-3-4	2-4-5	2-4-6	2-5-7	3-6-8	4-6-9	5-7-10	5-8-10
8" Round Neck	Airflow, cfm	100	120	140	160	180	220	240	260	300
48" x 24" Face	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
	Vert. Projection	1-1-3	1-2-4	1-3-5	2-4-6	2-5-7	3-6-8	3-6-9	4-7-10	5-8-10
60" x 24" Face	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
	Vert. Projection	1-1-3	1-2-3	1-3-5	2-4-6	2-5-7	3-6-8	3-6-9	4-7-10	5-8-10
72" x 24" Face	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
	Vert. Projection	1-1-3	1-2-3	1-3-5	2-4-6	2-5-6	3-6-8	3-6-9	4-7-10	5-8-10
10" Round Neck	Airflow, cfm	215	240	265	295	320	345	400	425	515
48" x 24" Face	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
	Vert. Projection	2-5-6	2-6-7	3-6-8	4-7-9	5-8-9	5-8-10	6-9-11	7-10-12	9-12-14
60" x 24" Face	Total Pressure	0.043	0.053	0.065	0.080	0.094	0.110	0.147	0.16	0.244
	NC (Noise Criteria)	19	22	25	28	31	33	38	40	45
	Vert. Projection	2-5-6	2-6-7	3-6-8	4-7-9	5-8-9	5-8-10	6-9-11	7-10-12	9-12-14
72" x 24" Face	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
	Vert. Projection	2-4-5	2-5-6	3-5-7	4-6-8	5-7-9	5-7-9	5-8-10	6-9-11	8-11-13
12" Round Neck	Airflow, cfm	215	240	265	295	320	345	400	425	515
48" x 24" Face	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
	Vert. Projection	2-5-6	2-6-7	3-6-8	4-7-9	5-8-9	5-8-10	6-9-11	7-10-12	9-12-14
60" x 24" Face	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
	Vert. Projection	2-5-6	2-6-7	3-6-8	4-7-9	5-8-9	5-8-10	6-9-11	7-10-12	9-12-14
72" x 24" Face	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
	Vert. Projection	2-4-5	2-5-6	3-5-7	4-6-8	5-7-8	5-7-9	5-8-10	6-9-11	8-11-15

- 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 70-2006 and 113.
- 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.

Critical Environment Diffusers | TLF | Specifications

Suggested Specifications

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 Standards 70-2006 and 113.

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. 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 1/4-inch centers. The free area of the face shall be 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

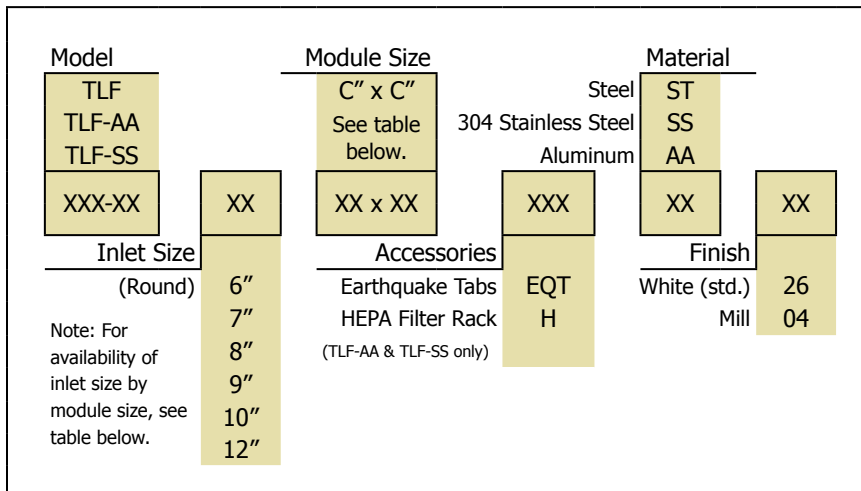
Air diffusers marked _____ shall be Titus model number TLF-AA. Diffusers shall be constructed using a maximum 6 inches tall backpan designed for optimum performance with the diffuser. The backpan shall have integral hanger tabs for

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 1/4-inch centers. The free area of the face shall be 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 1/4-inch centers. The free area of the face shall be 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



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

RadiaTec ●●●

High Volume Low Velocity Radial Air Diffusion Technology

Models:

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

These Products Include

- 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).

Overview

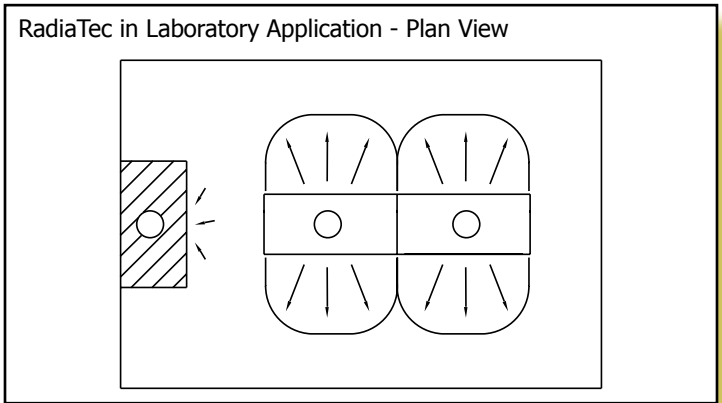
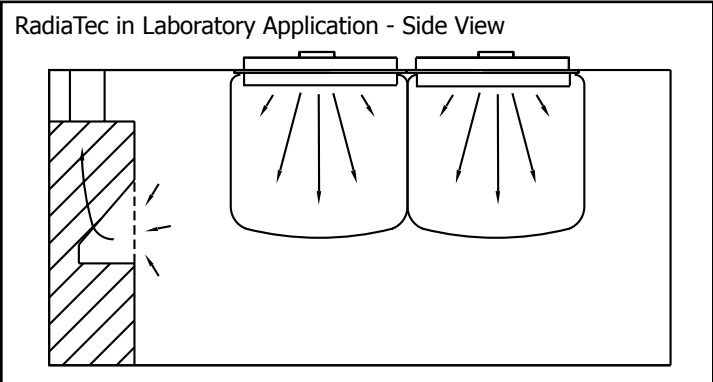
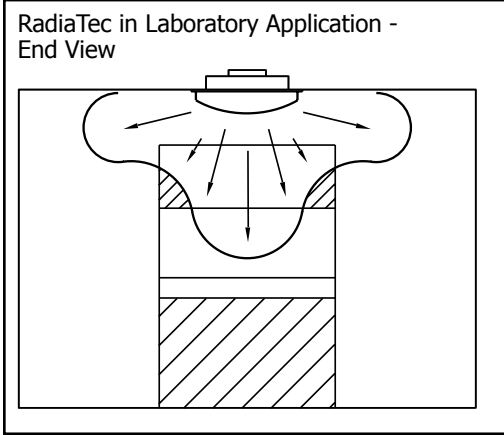
The RadiaTec diffuser is designed to meet the challenge of diluting airborne contaminants by supplying high- volume, low-velocity airflow to displace these impurities. The airflow pattern is designed to produce a uniform pattern to prevent dead spots where contaminants can linger. In addition, the air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



- 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.
- 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 and 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.



Dimensions - Without HEPA Filter Rack

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

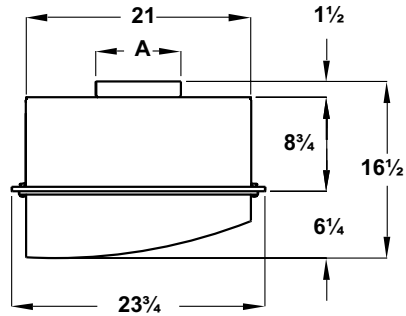
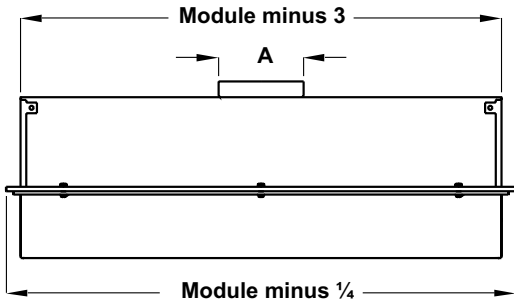
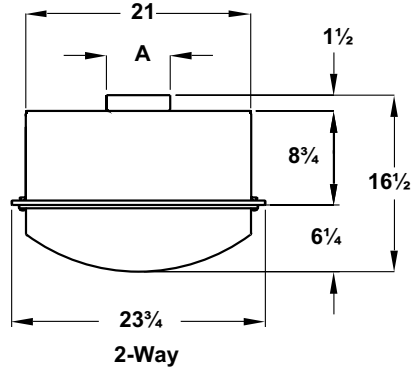
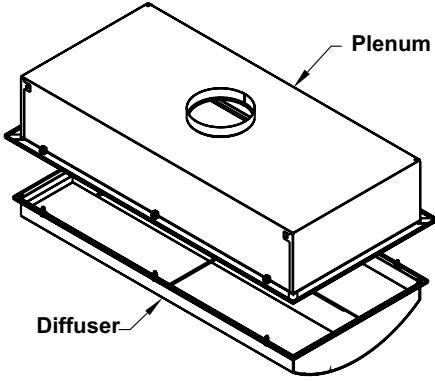
Border Detail Lay-in

Tee	A
1"	3 ³ / ₈
1 1/2"	1 ¹ / ₈ "

Surface Mounting with TRM frame

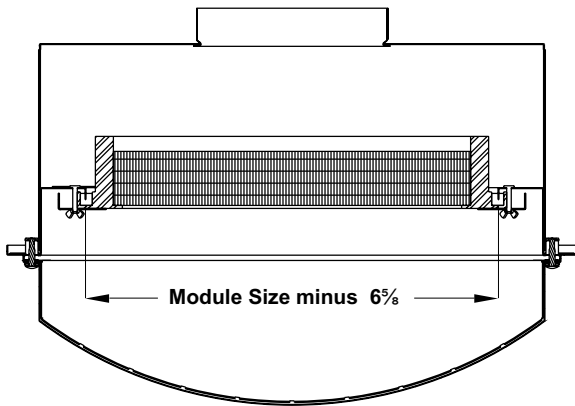
Dimensions - With HEPA Filter Rack

HEPA Filter Rack Model

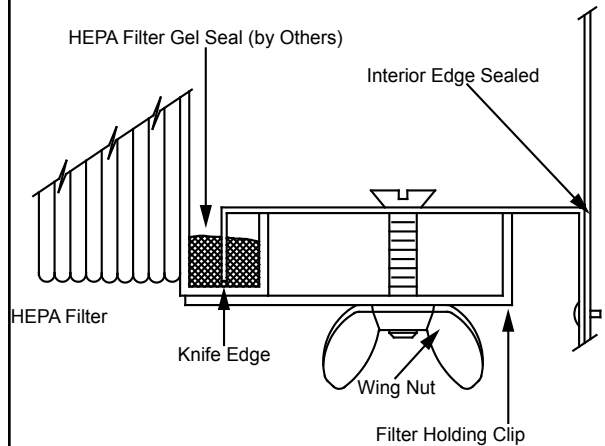


Module Size	Nominal Inlet Size	A
24 x 24	8	7 ⁷ / ₈
	10	9 ⁷ / ₈
48 x 24	10	9 ⁷ / ₈
	12	11 ⁷ / ₈

HEPA Filter Rack Knife Edge Dimensions



HEPA Filter Rack



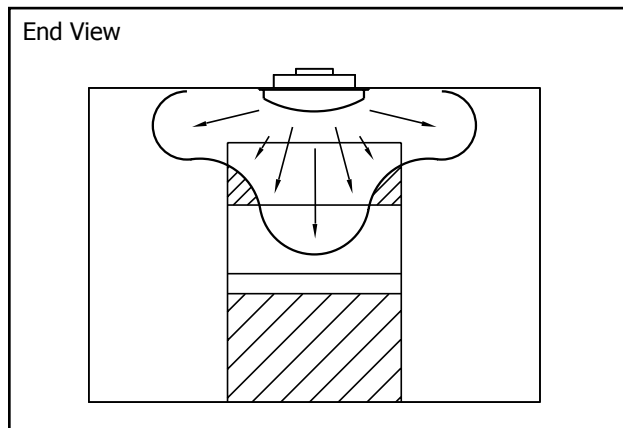
Critical Environment Diffusers | RadiaTec | Performance Data

Performance Data

RadiaTec-AL and RadiaTec-SS

Module Size Inlet Size	2-Way Pattern				Horizontal Throw (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		
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 Throw (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		
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.



Critical Environment Diffusers | RadiaTec | Specifications

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 ¼-inch staggard 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.

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 Standards 70-2006 and 113.

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.

Model Number Specification

Model	Module Size (Note1)		Blow Pattern	HEPA Filter Rack	Accessories (Note 2)
RadiaTec-AL	24 x 24		1-Way	1	H
RadiaTec-SS	48 x 24		2-Way	2	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.

LineaTec ●●●

Linear Air Curtain Technology Vertical Air Curtain 2-Slot Diffuser for Perimeter Control of Pollutants

Models:

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

These Products Include

- Standard Finish #26 White Face (aluminum models).
- #04 Mill Finish (304 stainless steel models and plenums).

Overview

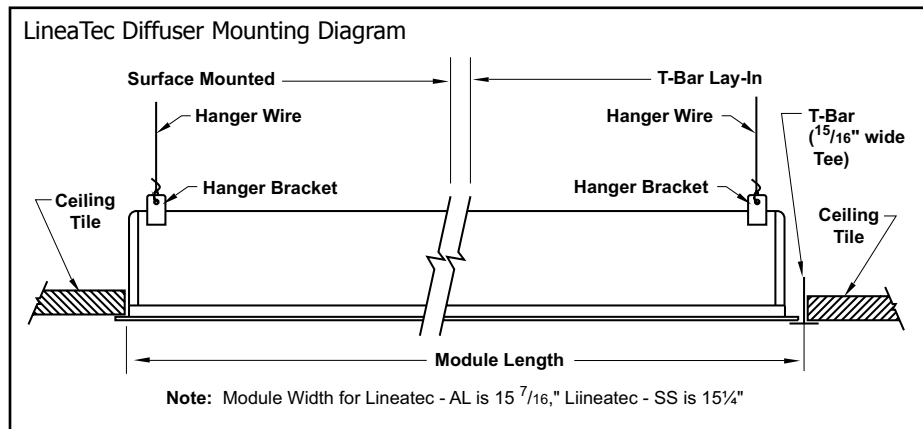
LineaTec is a linear air curtain diffuser used to create an air curtain barrier between a clean zone and the balance of the room. The air curtain typically discharges 25 to 50 cfm per linear foot of slot. Flow rates of up to 100 cfm per linear foot of diffuser can be obtained with a two-slot LineaTec. LineaTec diffusers surround TLF diffusers in operating rooms to reduce internal contaminants in 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.

- 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.



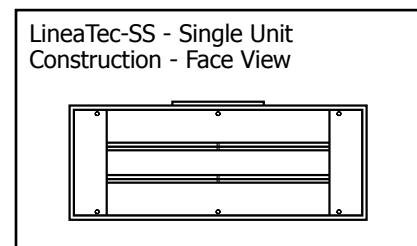
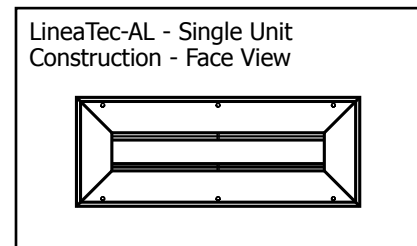
- Plenums available with square or round corners, quarter-turn fasteners for easy face removal and sanitizing.
- Excellent for use as a perimeter air curtain in clean air environments such as operating rooms.
- May be used in surface mount or lay-in applications.



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).



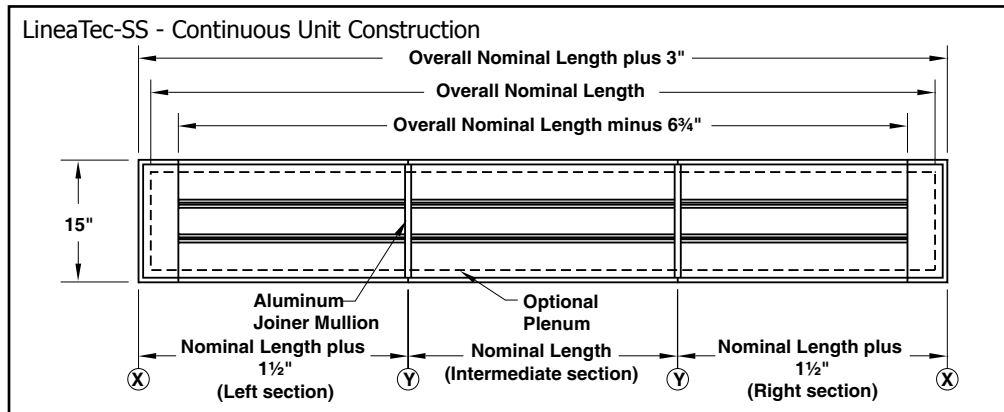
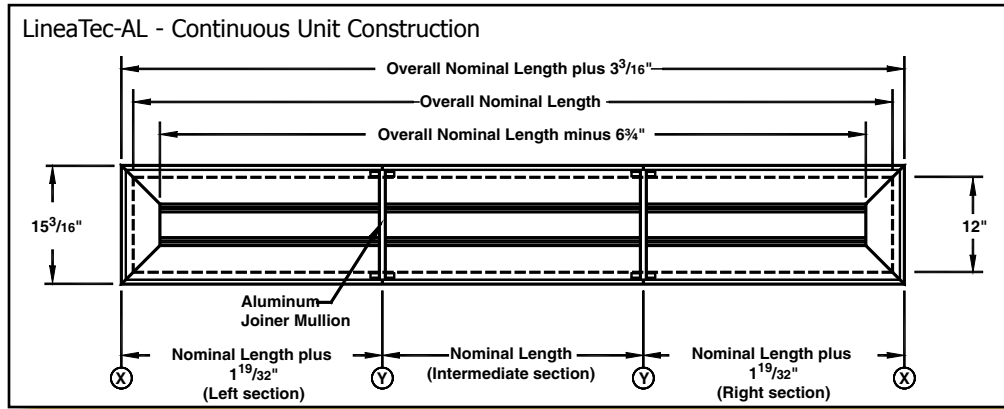
Critical Environment Diffusers | LineaTec | Dimensions

Dimensions

Continuous Unit Construction

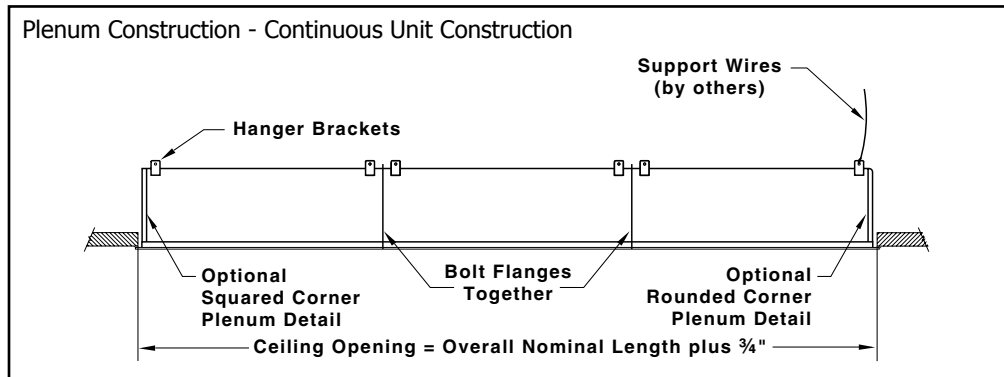
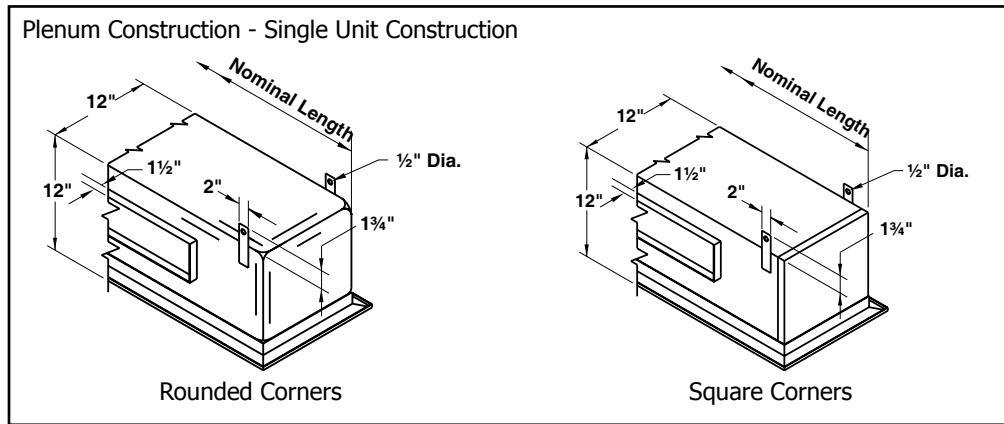
- Connected with aluminum joiner strips

Available Section Lengths (ft.)
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 D23.



Critical Environment Diffusers | LineaTec | Dimensions

Dimensions (continued)

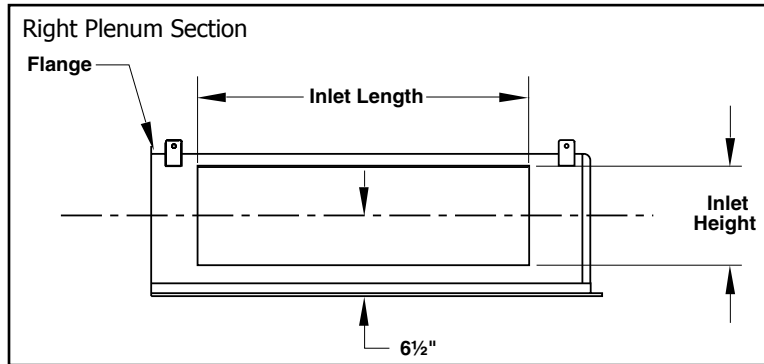
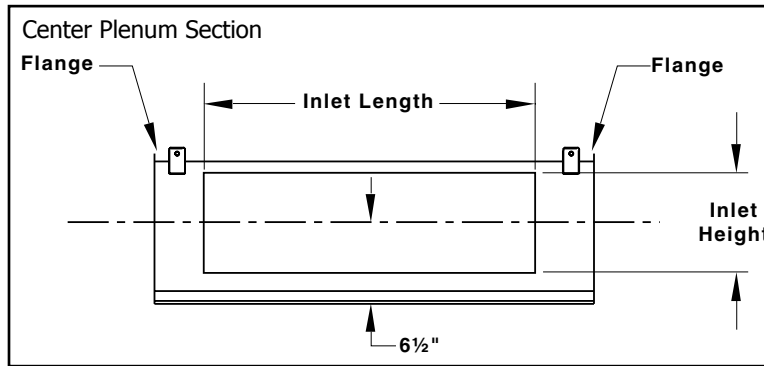
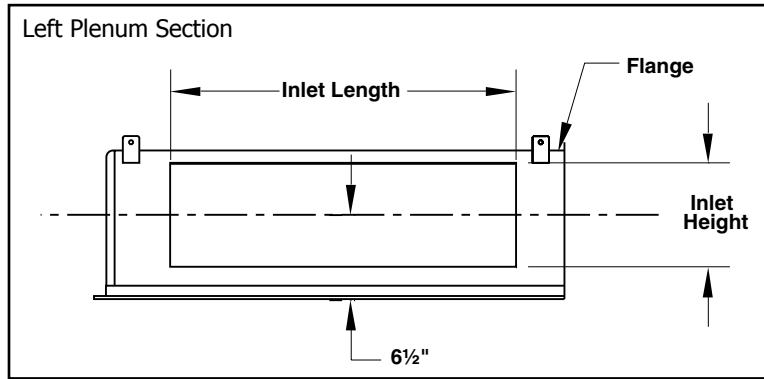
Optional Plenum Inlet

- 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.



Critical Environment Diffusers | LineaTec | Performance Data

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Performance Data

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 radiused corner and an 18 x 6-inch inlet.

Critical Environment Diffusers | LineaTec | Specifications

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 70-06 and 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.

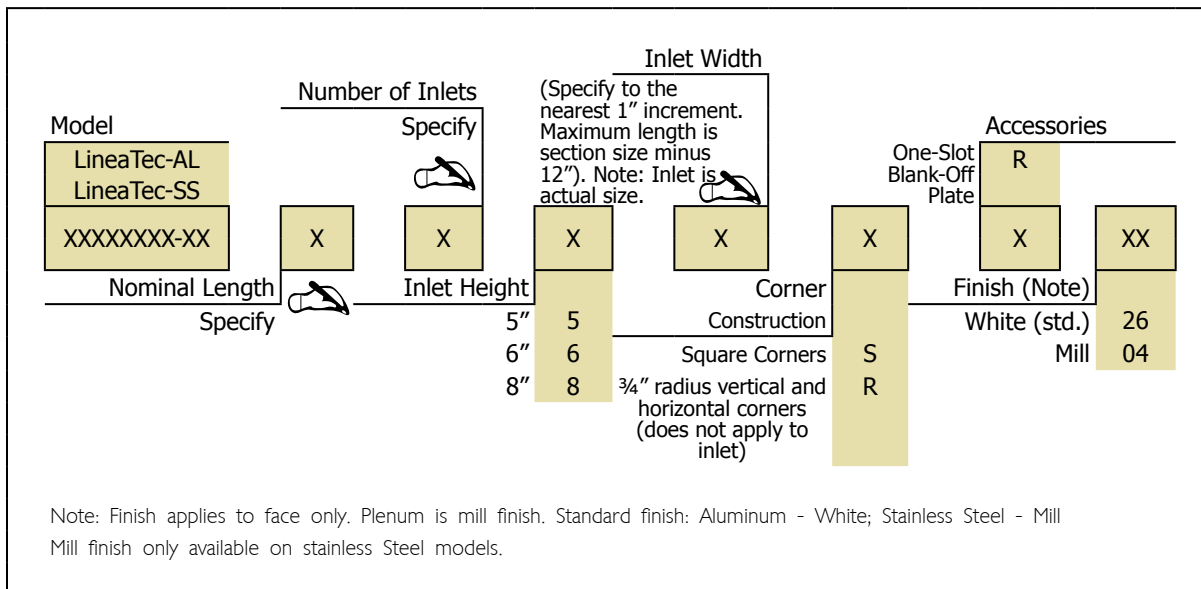
(Option-the plenum shall have square corners.) The plenum inlet shall be 5, 6 or 8 inches high and of sufficient length to reduce the velocity of incoming air to 1,000 fpm or less.

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

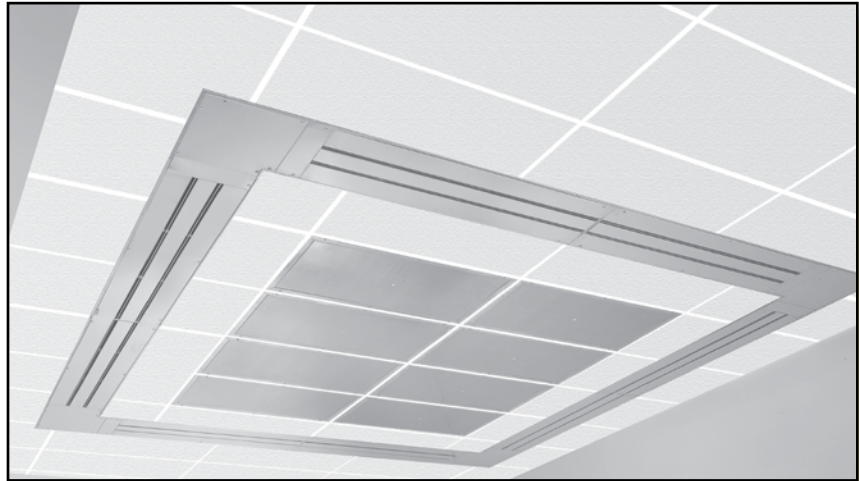


SteriTec ●●●

Sterile Environment System Technology

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.
- 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.
- 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 D34.

Critical Environment Diffusers | SteriTec | Description

Overview

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 plume 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 field can and should protect the patient and provide non-contaminated air flow protection for the patient and all equipment being used for the patient.

The terminal velocity of the laminar flow on the patient should not be greater than the plume 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 plume velocity is approximately 25-35 fpm.

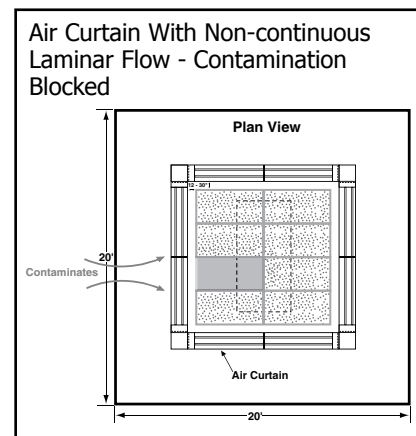
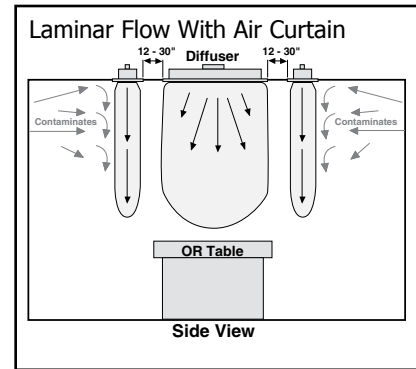
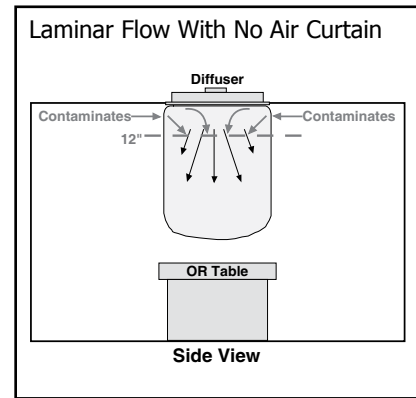
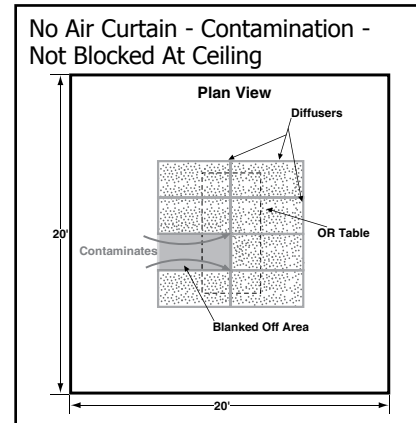
Ceiling area can be allowed in the sterile field for lighting and related services. Data has shown that if an air wall or air curtain like the SteriTec is used, room airflow entrainment is drastically reduced into the laminar flow sterile field with as much as 30% of the sterile field used for related 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.

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 6 inches above the floor to allow cleaning of the room's floor.



Critical Environment Diffusers | SteriTec | Dimensions

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Dimensions

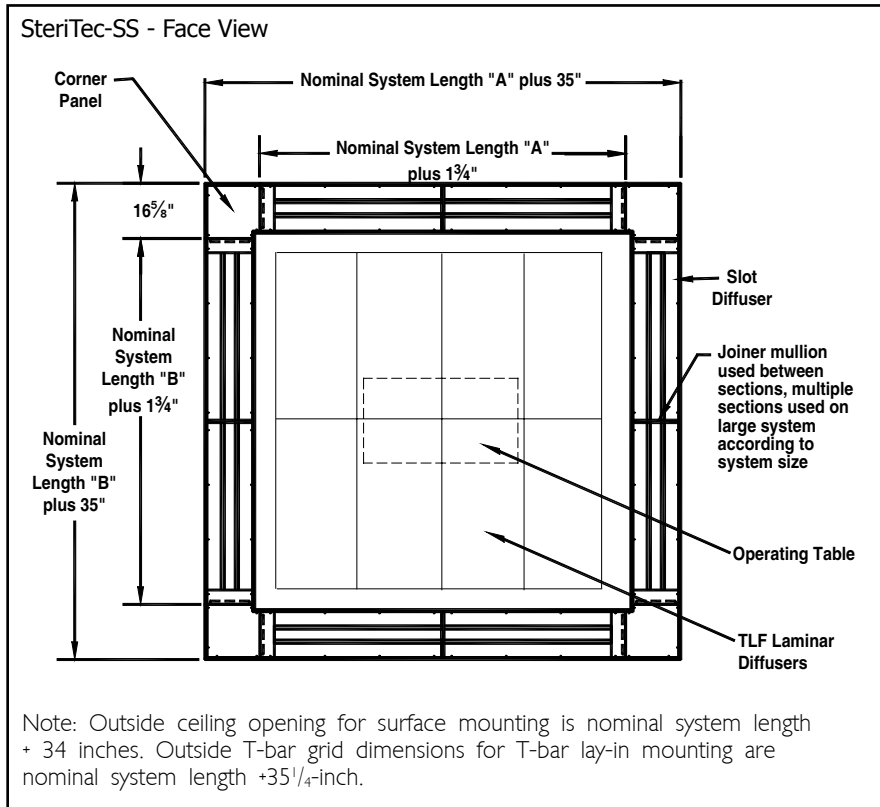
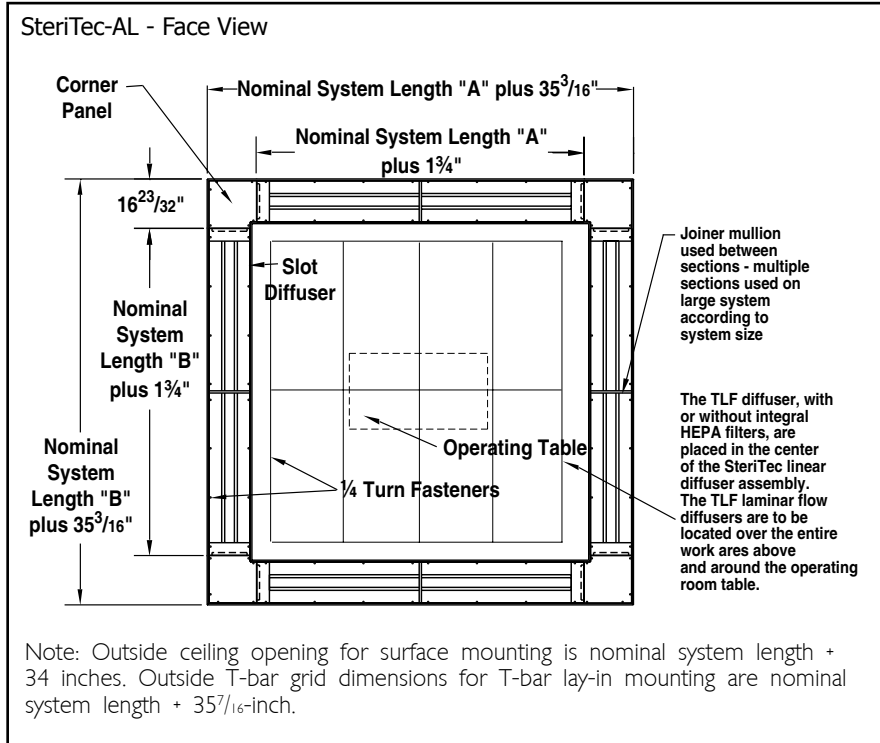
Material:

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

These Products Include

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

DIMENSIONS

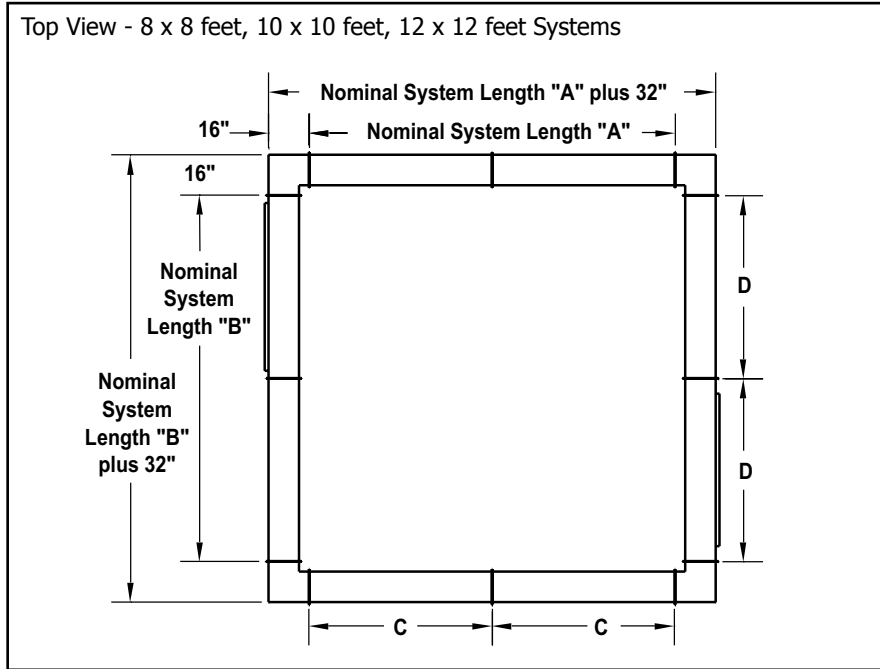


Critical Environment Diffusers | SteriTec | Dimensions

Linear Plenum Details

Plenums Include:

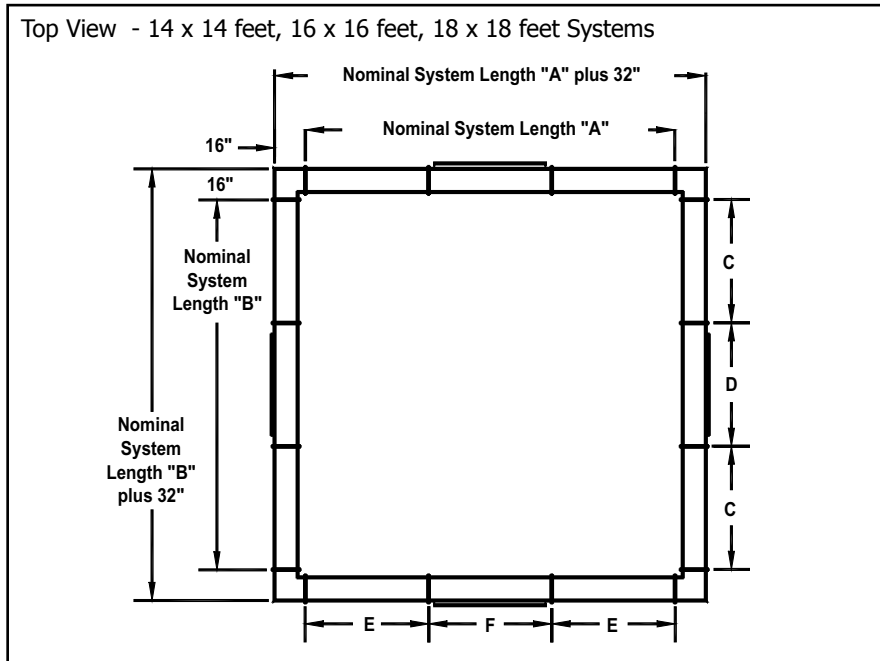
- Optional 3/4-inch radius on horizontal and vertical plenum corners (inlet does not have radius).
- Continuously welded seams ground smooth to make hand cleaning easy.
- Corners have no crevices on radiused plenums to trap contaminants or mold.
- 12-inch width to facilitate cleaning.
- Optional square 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

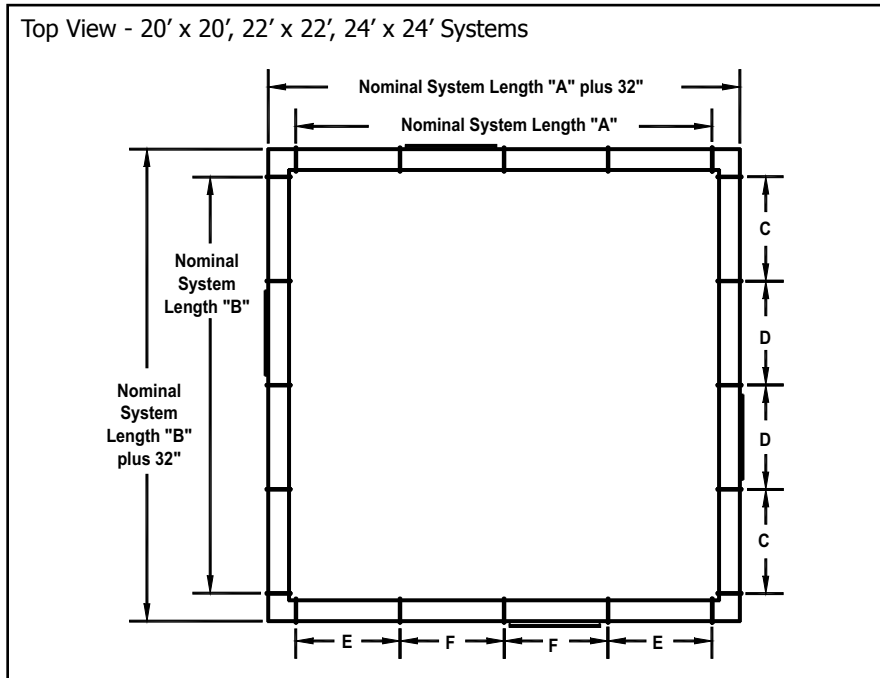
Nominal Plenum Lengths

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



Critical Environment Diffusers | SteriTec | Dimensions

Linear Plenum Details (continued)



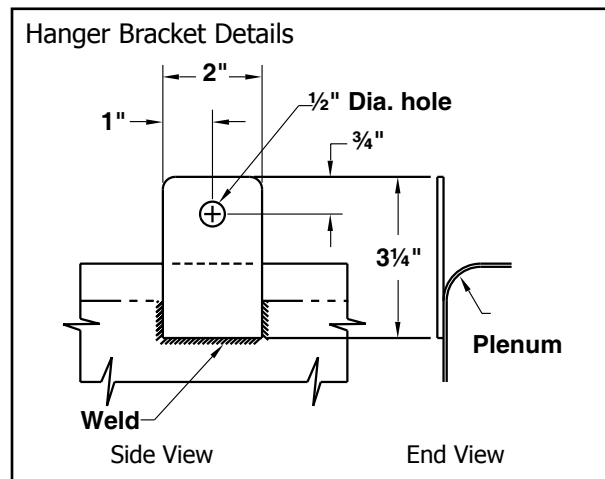
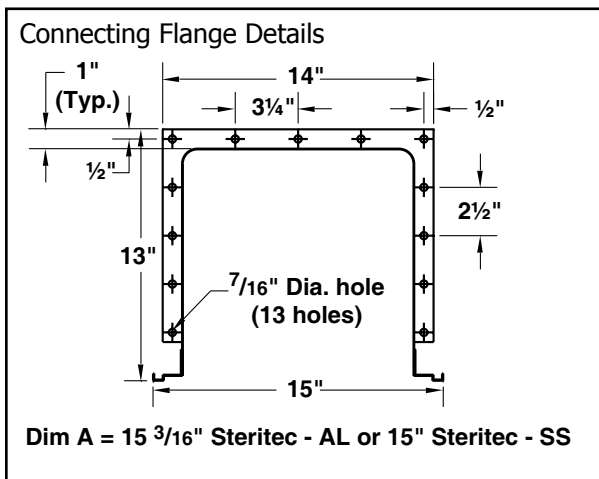
Nominal Plenum Lengths

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

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

Flange and Hanger Bracket Details

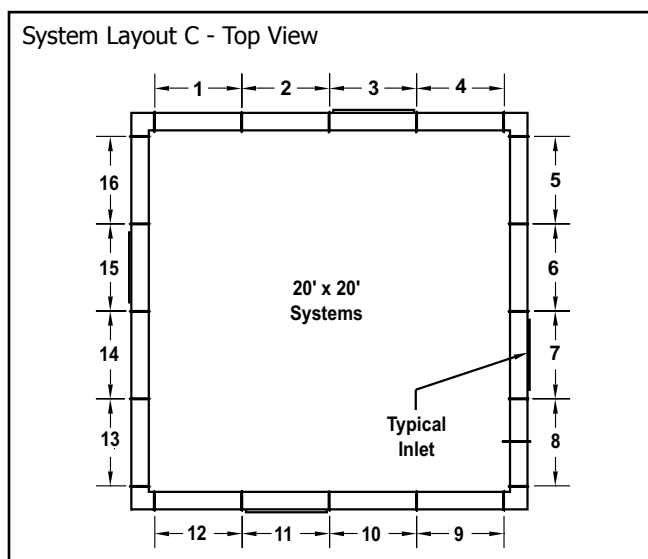
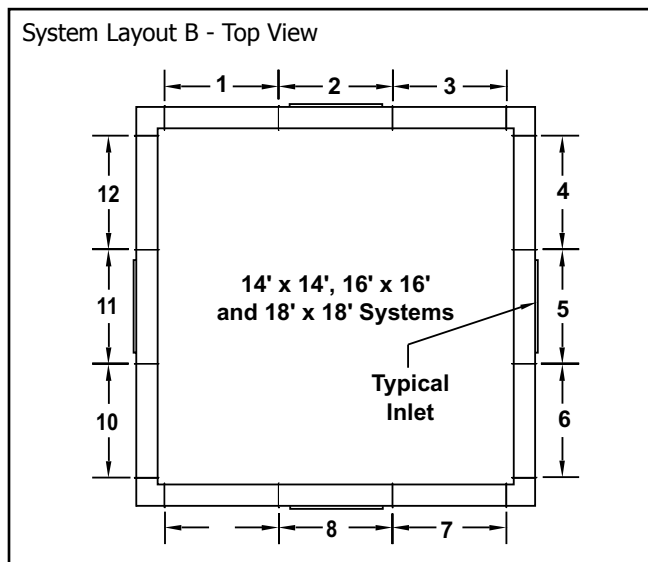
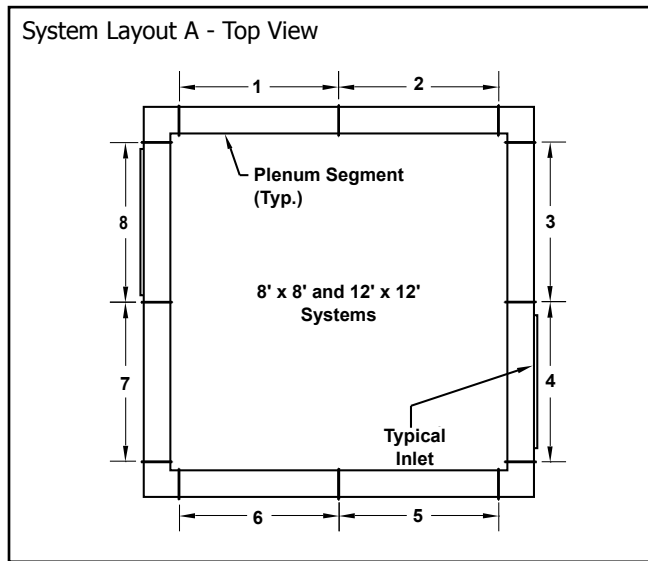
Note: All systems must be suspended by wire whether surface mount or lay-in.



Critical Environment Diffusers | SteriTec | Plenum Inlet Locations

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.



Critical Environment Diffusers | SteriTec | Specifications

Suggested Specifications

SteriTec-AL
SteriTec-SS

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

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 _____

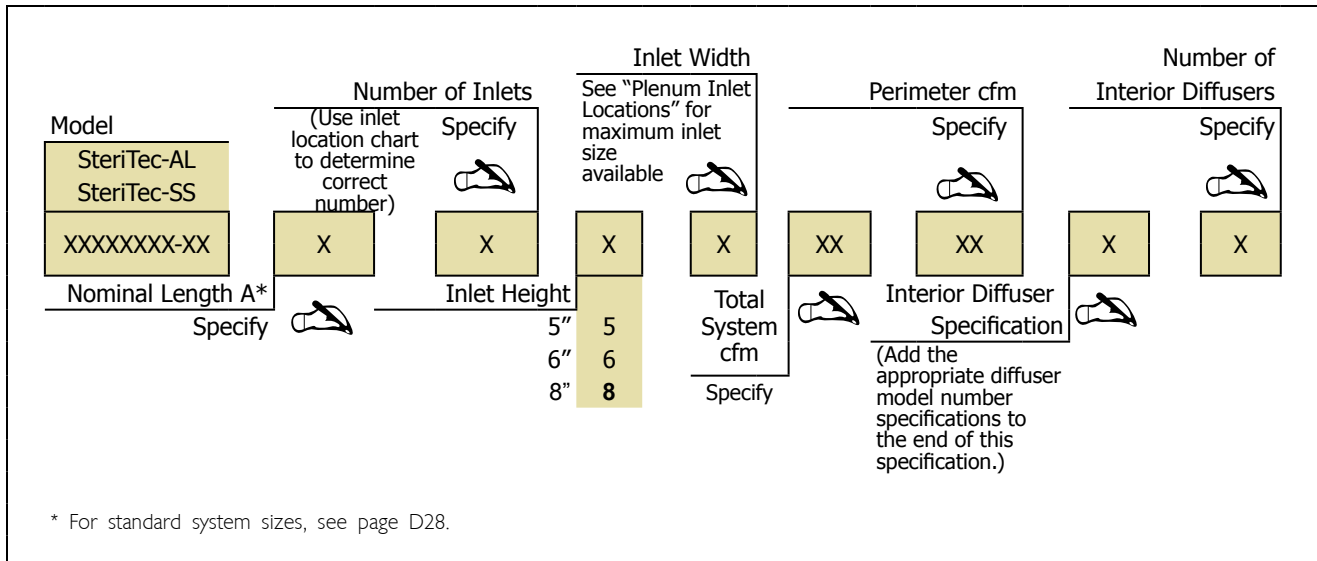
Perimeter Air Curtain cfm _____

Number of TLF Diffusers _____

cfm/TLF Diffuser _____

cfm/Linear ft. of Slot Diffuser _____

Model Number Specification



Critical Environment Diffusers | ModuTec

ModuTec ●●●

Modular Surgical System Technology

Models:

- ModuTec-D • Diffuser
- ModuTec-G • Grid

These Products Include

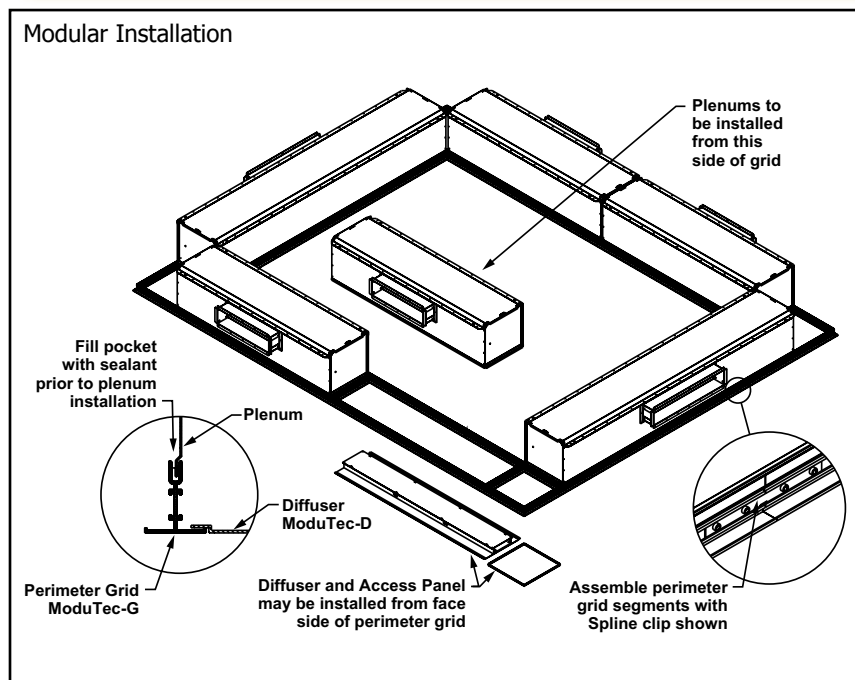
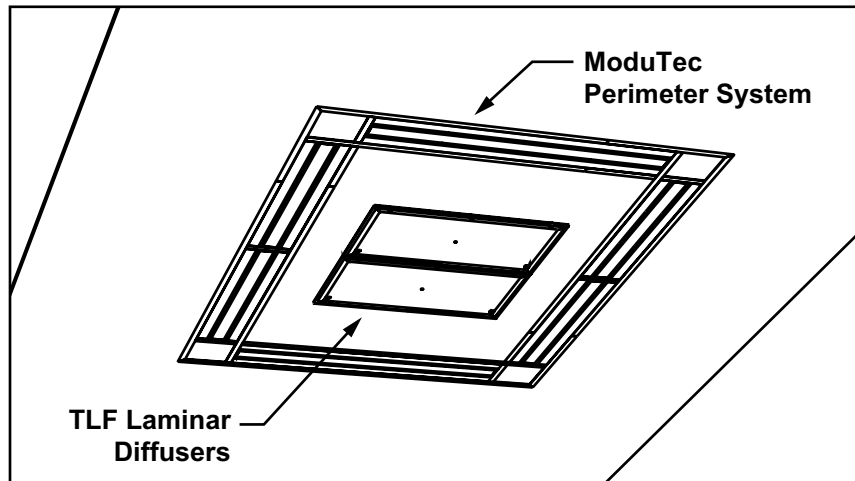
- Standard Finish
Face & Grid: #26 White
Plenum: Mill
- ModuTec is a 2-slot perimeter air curtain system.
- Excellent for use as a perimeter air curtain in clean air environments such as operating rooms.
- Integral grid system is provided for easy installation in the field.
- Diffuser face lays in T-bar grid eliminating the need for 1/4" turn fasteners.

- Inlet can be located on right, left, or center of plenum to allow for design flexibility in the field
- Plenum has 45 degree radius corners for easy cleaning.
- Retainer cables (2 per plenum) are provided to secure face.
- Optional blank-off for diffuser face
- Construction is aluminum material for plenum and diffuser face; aluminum material with miscellaneous steel parts for grid.
- Perimeter T-bar is 1 1/2" wide, compatible with standard 1 1/2" wide T-bar systems by others.

Overview

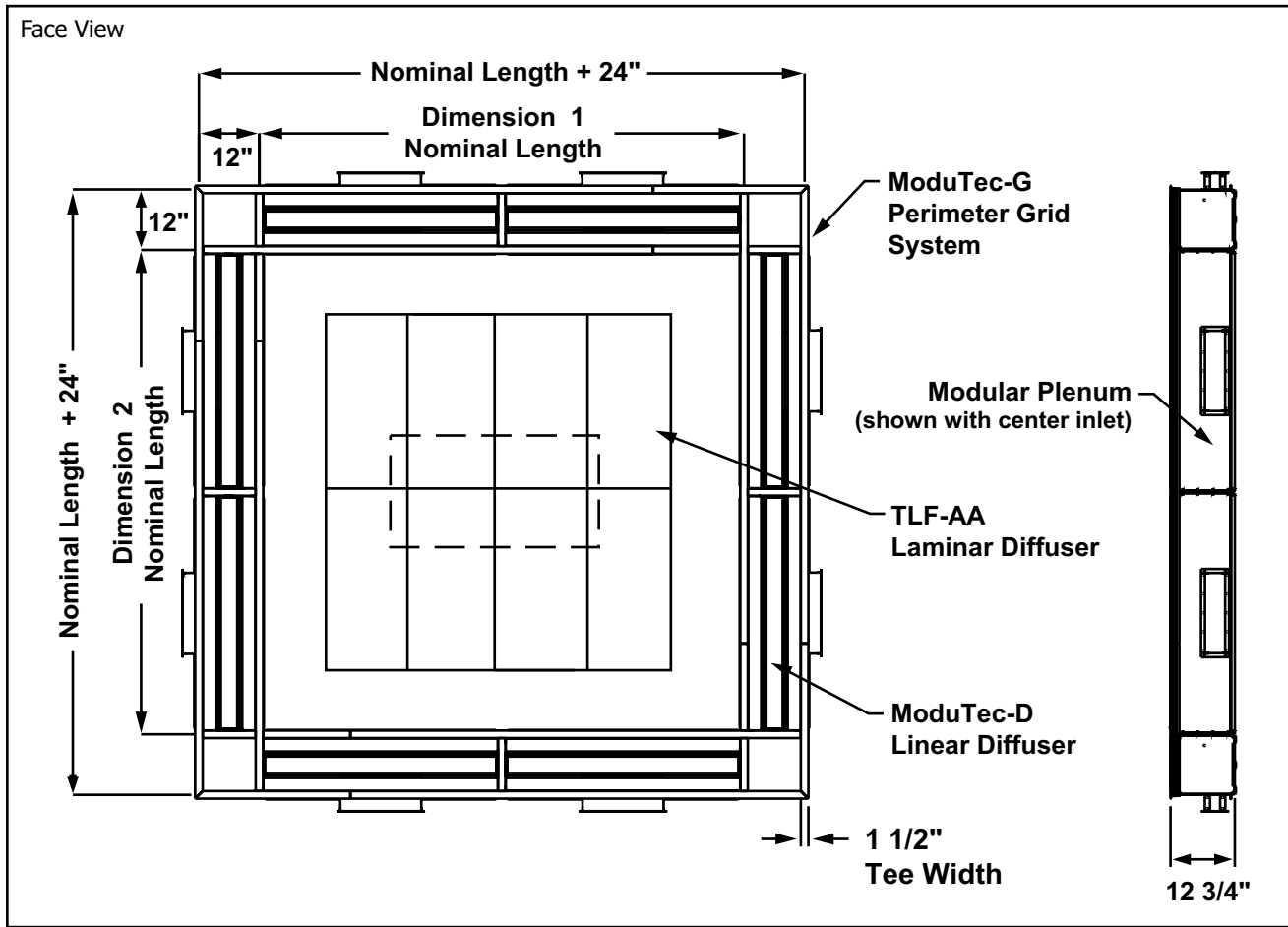
ModuTec is a perimeter air curtain system used to create a barrier between a clean zone and the balance of the room. The air curtain typically discharges 20 to 50 cfm per linear foot of slot. Flow rates of up to 100 cfm per linear foot can be obtained with a two-slot ModuTec diffuser. ModuTec diffusers surround TLF diffusers in operating rooms to reduce internal contaminants in 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, ModuTec diffusers have plenums with 45 degree radius corners. 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 ModuTec diffusers based on 50 fpm terminal velocity at knee height of 24 to 36 inches above the floor – for most operating room applications.



Dimensions

DIMENSIONS



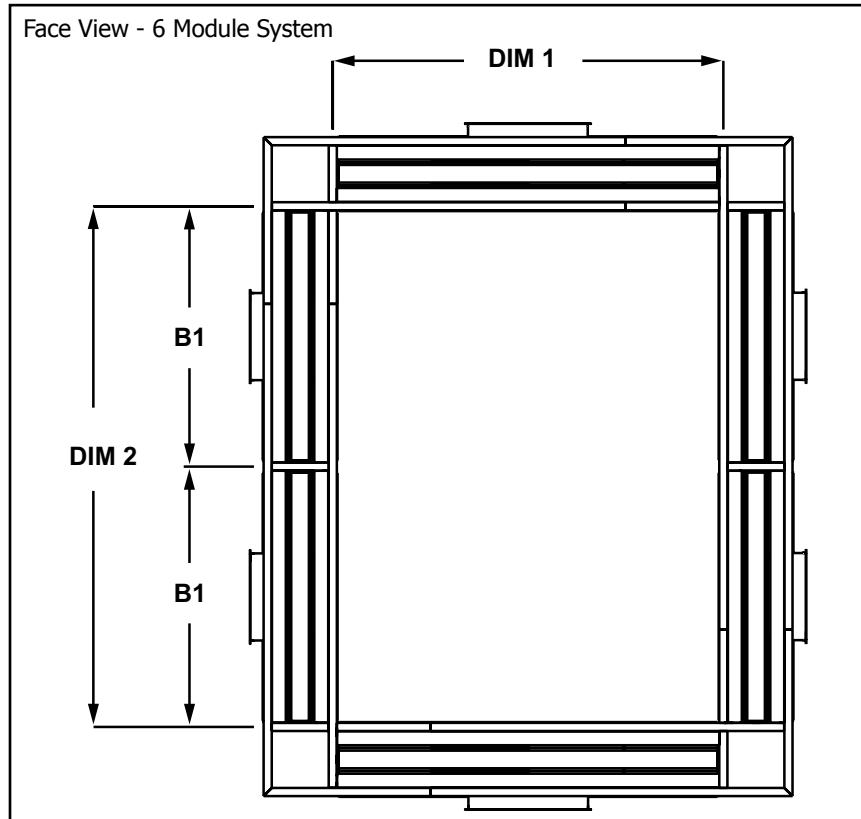
Typical System Sizes

Typical Modular Sizes Dim 1, Dim 2	No. of Linear Diffusers Per System	Linear Flow cfm @ 40 cfm/ft ²	Laminar Flow Sizes	Laminar Flow cfm @ 30 cfm/ft ²	Total cfm
6' x 8'	(2) 6 ft., (4) 4 ft.	1,120	(4) 2x4 TLF	960	2,080
8' x 10'	(4) 4 ft., (4) 5 ft.	1,440	(4) 2x6 TLF	1,440	2,880
10' x 10'	(8) 5 ft.	1,600	(8) 2x4 TLF	1,920	3,520
12' x 12'	(8) 6 ft.	1,920	(8) 2x4 TLF	1,920	3,840
10' x 16'	(8) 5 ft., (2) 6 ft.	2,080	(14) 2x4 TLF	3,360	5,440
14' x 14'	(8) 5 ft., (4) 4 ft.	2,240	(15) 2x4 TLF	3,600	6,440
14' x 16'	(2) 4 ft., (8) 5 ft., (2) 6 ft.	2,400	(18) 2x4 TLF	4,320	6,720

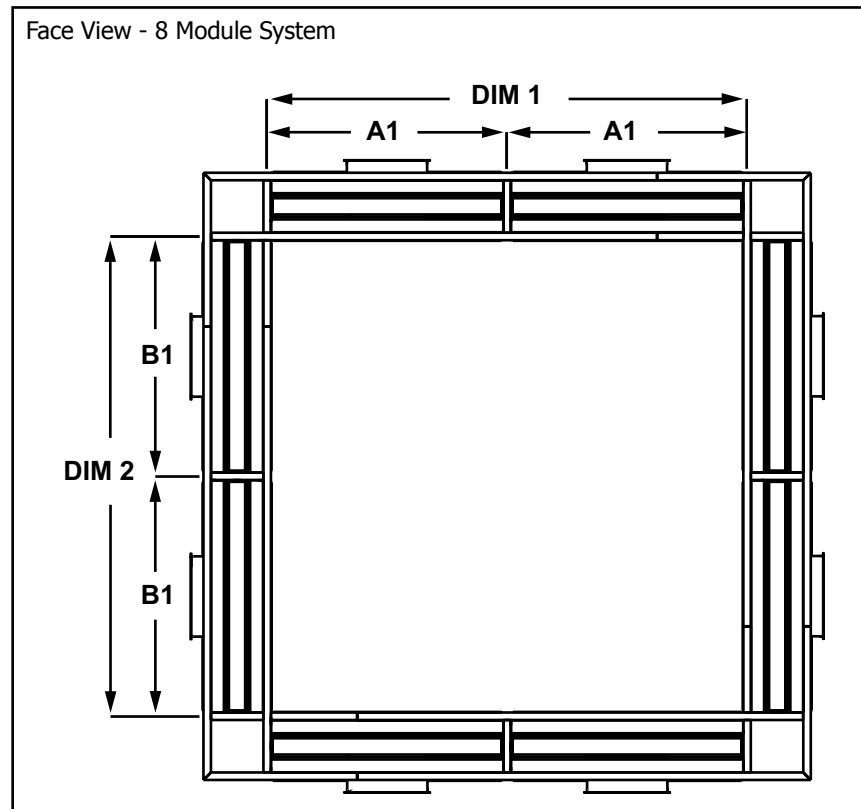
Critical Environment Diffusers | ModuTec | Module System Details

Module System Details

6 Module Perimeter System (ft)			
System Size	Dim 1	Dim 2	Diffuser Length
			B1
6 x 8	6	8	4
6 x 10	6	10	5



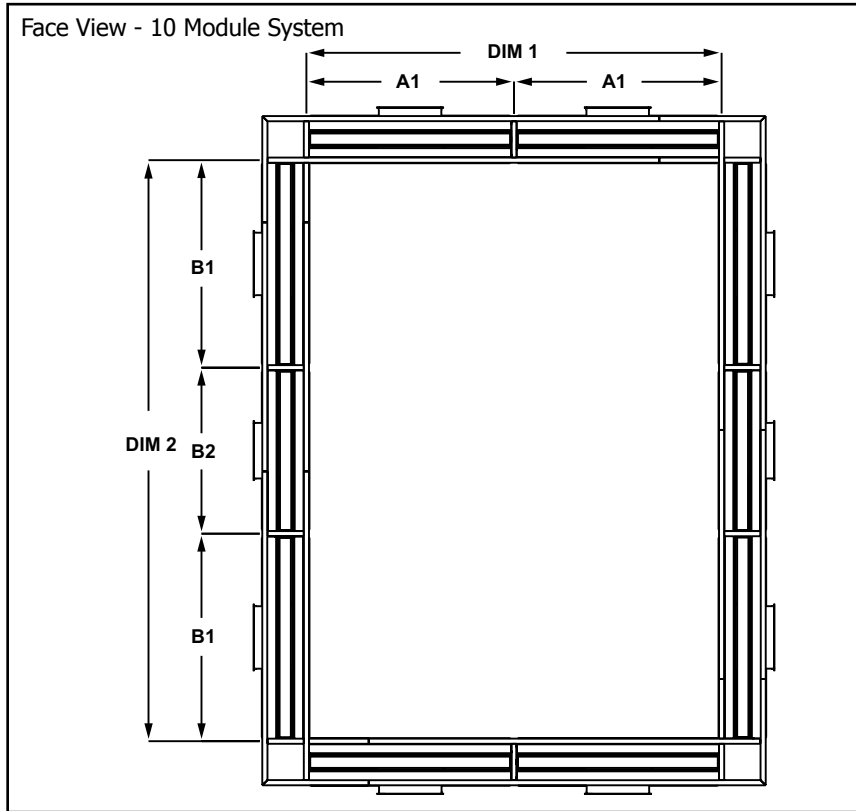
8 Module Perimeter System (ft)				
System Size	Dim 1	Dim 2	Diffuser Length	
			A1	B1
8 x 8	8	8	4	4
8 x 10	8	10	4	5
8 x 12	8	12	4	6
10 x 10	10	10	5	5
10 x 12	10	10	5	6
12 x 12	12	12	6	6



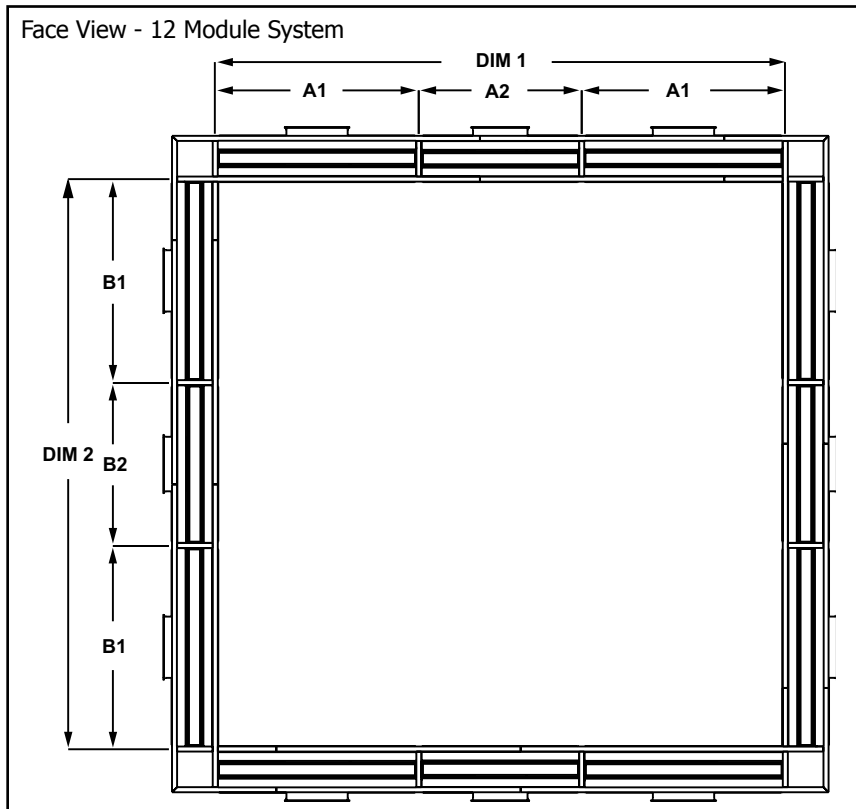
Critical Environment Diffusers | ModuTec | Module System Details

Module System Details (continued)

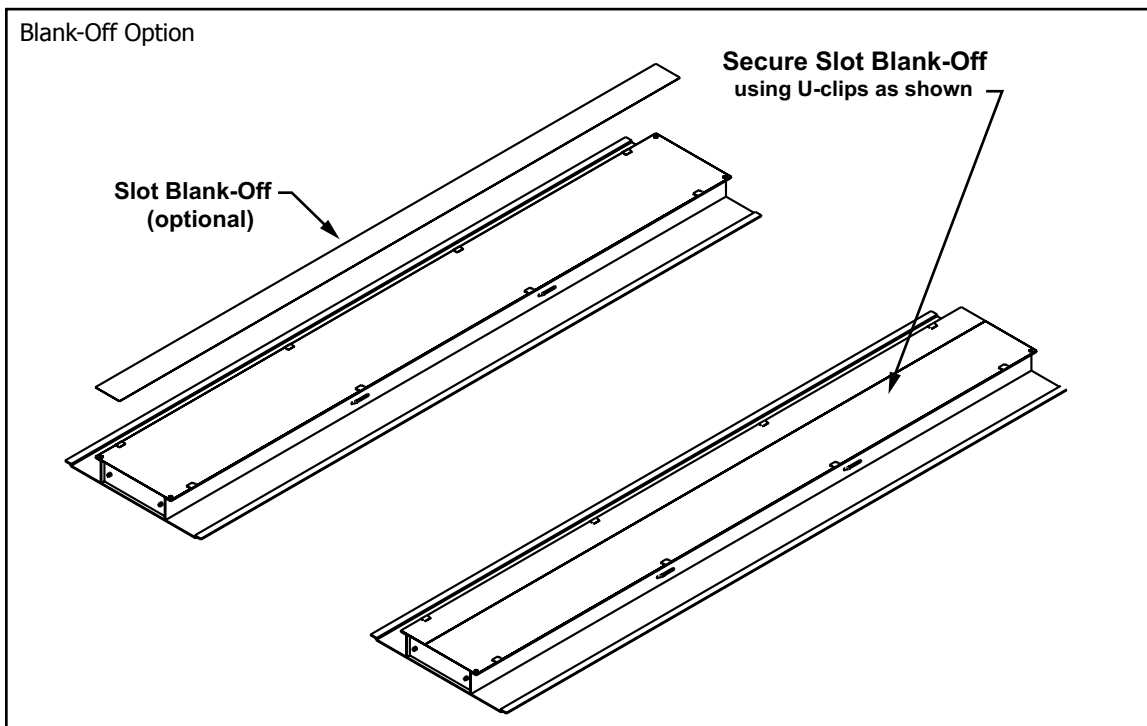
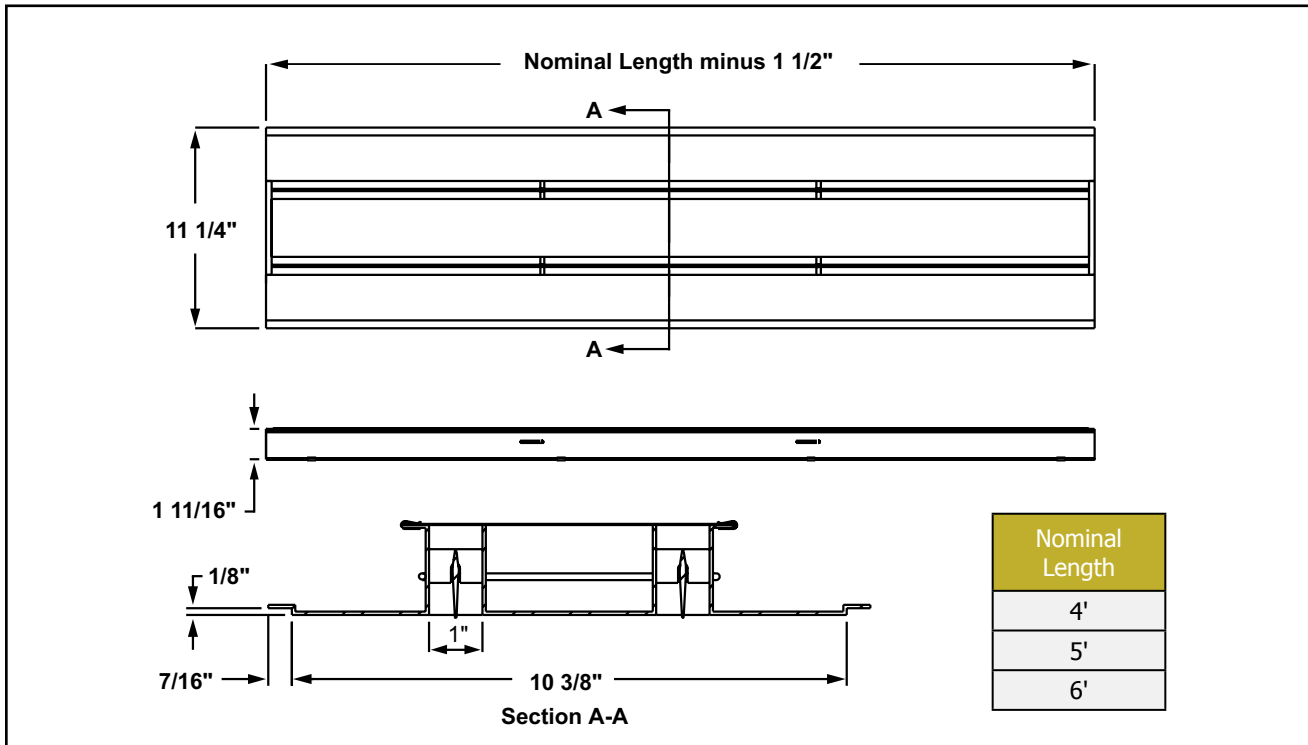
10 Module Perimeter System (ft)					
System Size	Dim 1	Dim 2	Diffuser Length		
			A1	B1	B2
8 x 14	8	14	4	5	4
10 x 14	10	14	5	5	4
10 x 16	10	16	5	5	6
12 x 14	12	14	6	5	4
12 x 16	12	16	6	5	6
12 x 18	12	18	6	6	6



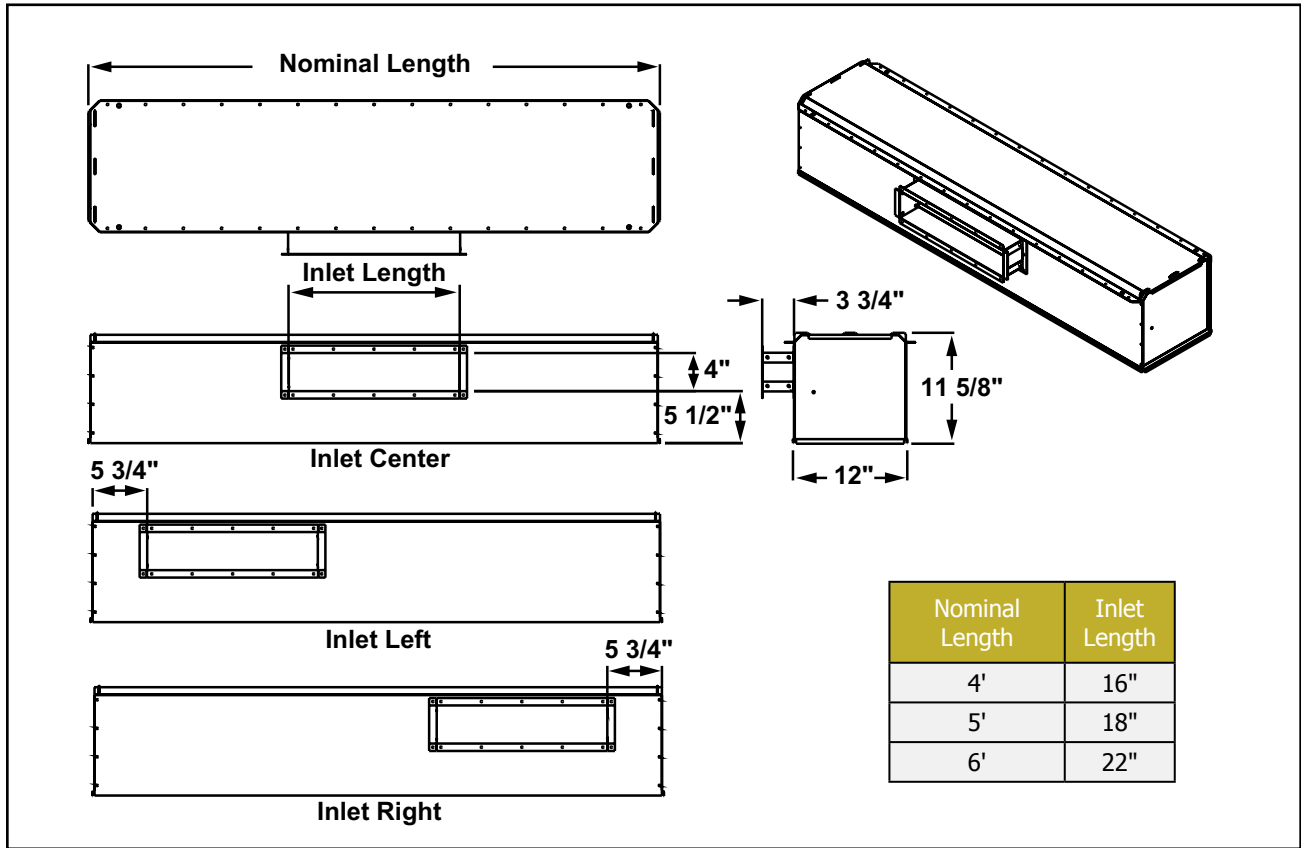
12 Module Perimeter System (ft)						
System Size	Dim 1	Dim 2	Diffuser Length			
			A1	A2	B1	B2
14 x 14	14	14	5	4	5	4
14 x 16	14	16	5	4	5	6
14 x 18	14	18	5	4	6	6



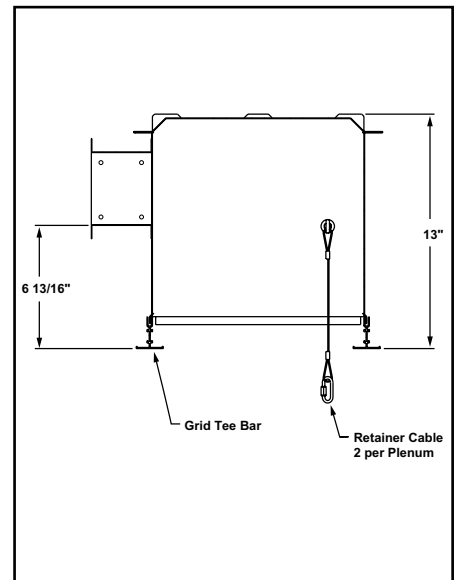
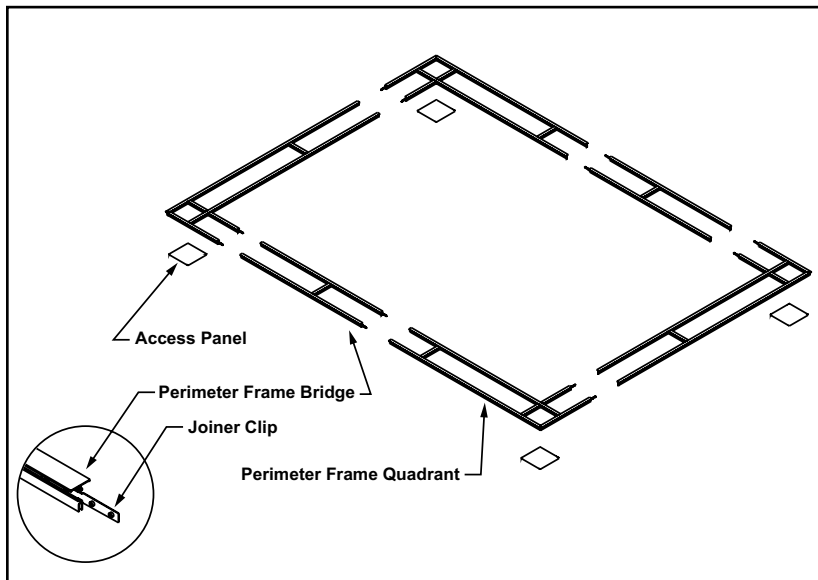
Diffuser Details



Plenum Inlet Details



Grid Details



Critical Environment Diffusers | ModuTec | Performance Data

Performance Data

ModuTec

1-Slot	Airflow, cfm/Ft.	20	30	40	50	60	70	80
	Static Pressure	0.016	0.037	0.067	0.105	0.150	0.206	0.268
	NC (Noise Criteria)	<10	<10	<10	13	16	19	24
	Throw	1-2-6	2-5-7	4-6-8	6-7-9	6-7-10	6-8-11	7-9-(12)
2-Slot	Airflow, cfm/Ft.	20	40	60	80	100	120	140
	Static Pressure	0.004	0.016	0.037	0.067	0.105	0.150	0.206
	NC (Noise Criteria)	<10	<10	<10	19	26	31	37
	Throw	0-0-4	2-4-8	5-7-10	6-8-(12)	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 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 and an 22 x 4-inch inlet.

Critical Environment Diffusers | ModuTec | Specifications

Suggested Specifications

ModuTec-D
ModuTec-G

ModuTec

Linear air diffusers marked _____ shall be Titus model ModuTec. Diffuser shall consist of aluminum face and separate aluminum plenum. Diffuser face shall be constructed for a 12-inch wide plenum. The diffuser face shall be a two-slot design with provision for disabling one slot with a blank off. Diffuser face shall be available in one-piece construction in lengths of 4, 5, and 6 feet. Slots shall include adjustable blades with a minimum adjustment range of 5 degrees to 15 degrees. Diffuser face shall be constructed of heavy gauge extruded aluminum. Diffuser face shall lay on interior edges of mounting grid. ¼ turn fasteners shall not be used to attach face. Plenum shall consist of 3-piece construction and be available in lengths of 4, 5, and 6 feet. Plenum inlet shall be located on right,

left, or center of plenum. The plenum inlet shall be 4 inches high and 16, 18, or 22 inches long depending on plenum length. Outer corners of the plenum shall have a radius of 45 degrees. Plenum shall have two retainer cables to attach and secure diffuser face. Plenum shall be constructed of aluminum. Mounting grid shall be provided to facilitate mounting of diffusers and plenums in sheetrock or suspended ceilings. Grid shall be constructed of heavy gauge extruded aluminum.

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 113.

Model Number Specification

Model	Inlet Location		Accessories	
ModuTec-D (diffuser)	Left	L	One Slot	B
ModuTec-FO (face only)	Center	C	Blank Off	
ModuTec-PO (plenum)	Right	R		
XXXXXXXX-XX		X	XX	X
	Nominal Length		Finish*	
	4'	4	White (std.)	26
	5'	5	Mill	04
	6'	6		
		Inlet Height		
		5"		
		6"		
		8"		

* Finish applies to face only. Plenum is mill finish. Standard finish for face is white.

Model	System Size*		Finish
ModuTec-G (mounting grid)		Dim 2	
XXXXXXXX-X		8	
		10	
		12	
		14	
		16	
		18	
		22	26
	System Size*		
	6		
	Dim 1		
	8		
	10	XX	
	12		
	14		
			White (std.) 26
			Only available in #26 white

*Available System Sizes:

6 x 8	8 x 14	10 x 16	12 x 18
6 x 10	10 x 10	12 x 12	14 x 14
8 x 8	10 x 12	12 x 14	14 x 16
8 x 10	10 x 14	12 x 16	14 x 18
8 x 12			

Accessories ●●●

HEPAALERT

HEPA Filter LED Light Kit

Models:
HEPAALERT

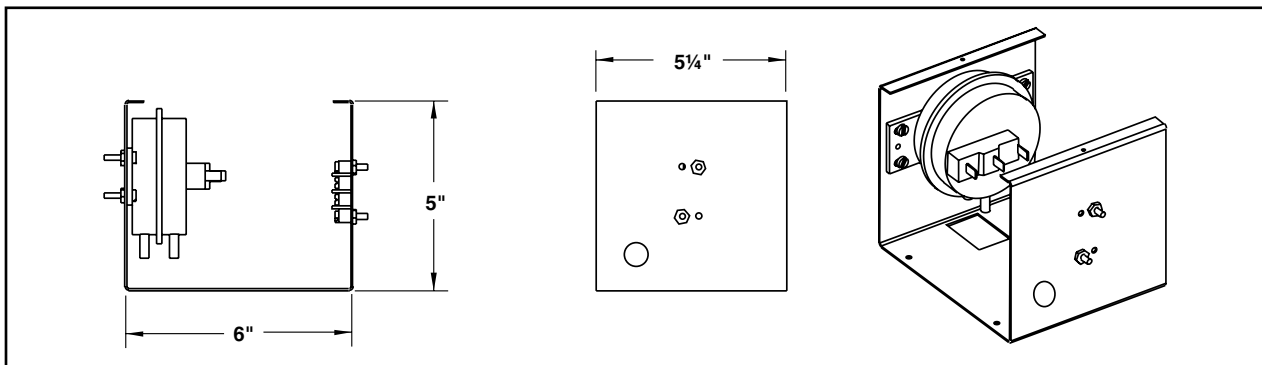
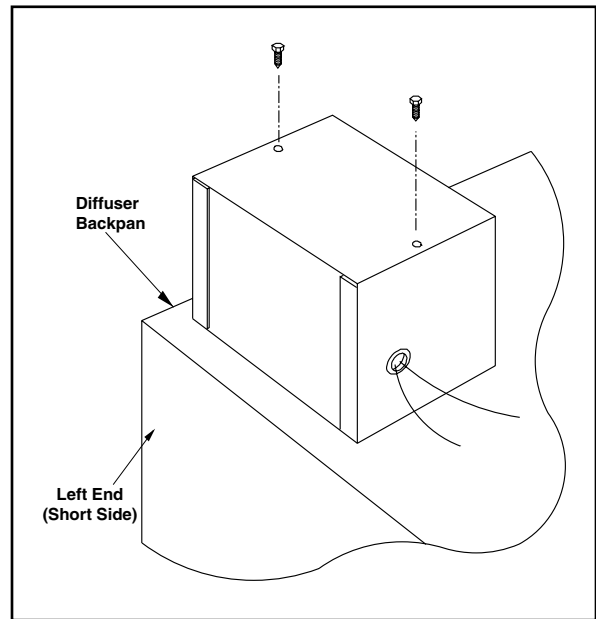
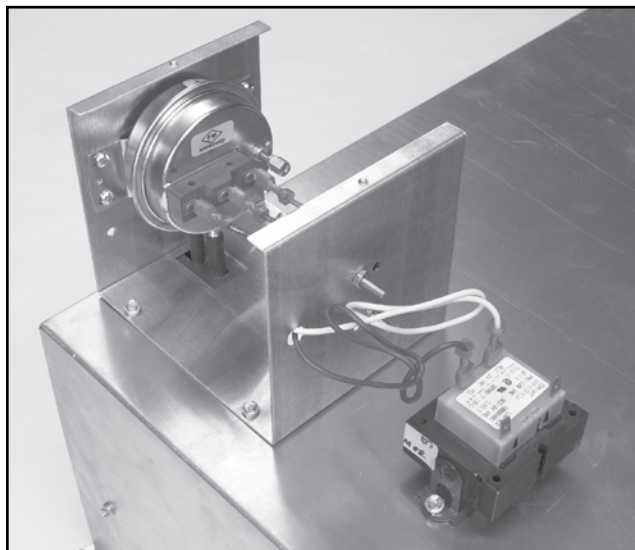
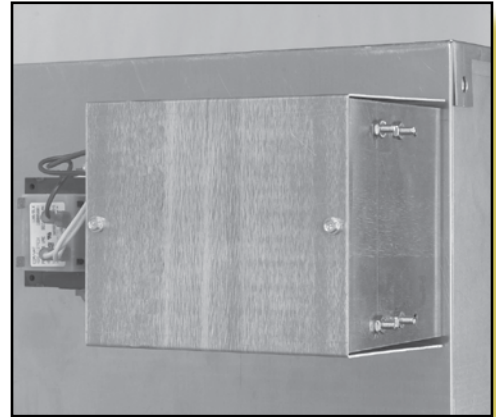
HEPAALERT, HEPA Filter LED Light Kit for TLF and RadiaTec diffusers with HEPA filter.

The HEPAALERT 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).

- HEPAALERT 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.
- HEPAALERT 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.
- 24 VAC transformer required (supplied by others).

- Filter operation is unaffected by room pressure changes.

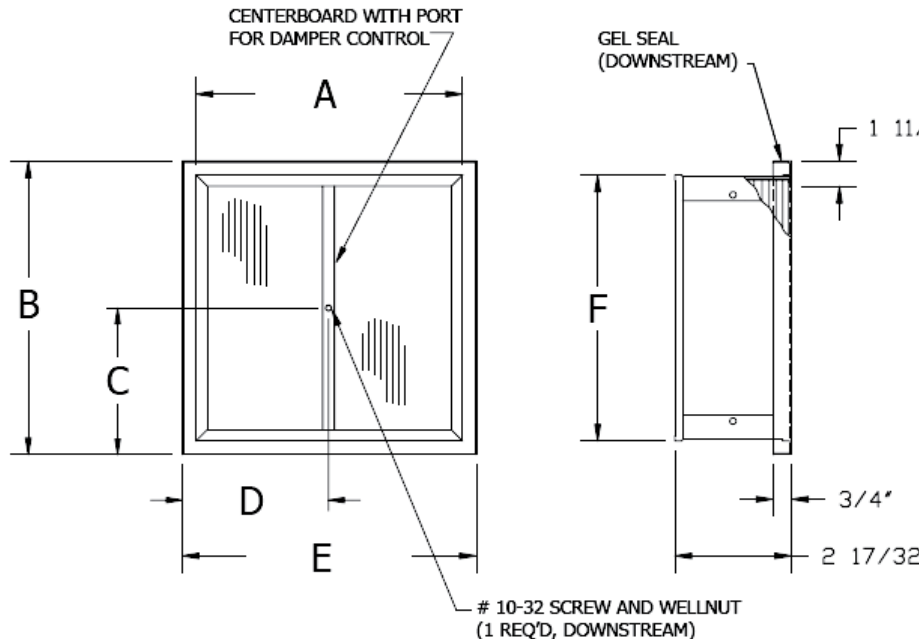


Critical Environment Diffusers | Accessories | HEPA FILTER

Accessories (continued)

HEPA Filter

HEPA FILTER



Filter Part Number	Nominal Size	A	B	C	D	E	F	Effective Face Area (Sq ft)
HF4812T	48x12	40-3/8"	5-3/4"	2-7/8"	20-7/8"	41-3/4"	4-3/8"	0.80
HF7212T	72x12	64-3/8"	5-3/4"	2-7/8"	32-7/8"	65-3/4"	4-3/8"	1.30
HF2424T	24x24	16-3/8"	17-3/4"	8-7/8"	8-7/8"	17-3/4"	16-3/8"	1.45
HF3624T	36x24	28-3/8"	17-3/4"	8-7/8"	14-7/8"	29-3/4"	16-3/8"	2.70
HF4824T	48x24	40-3/8"	17-3/4"	8-7/8"	20-7/8"	41-3/4"	16-3/8"	3.95
HF6024T	60x24	52-3/8"	17-3/4"	8-7/8"	26-7/8"	53-3/4"	16-3/8"	5.20
HF7224T	72x24	64-3/8"	17-3/4"	8-7/8"	32-7/8"	65-3/4"	16-3/8"	6.45
HF4836T	48x36	40-3/8"	29-3/4"	14-7/8"	20-7/8"	41-3/4"	28-3/8"	7.10

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 air flow will be a maximum of 0.52" water gauge at 100 fpm. Refer to chart 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%.

Critical Environment Diffusers | Accessories | HEPA FILTER

Accessories (continued)

Nominal Filter Size								
48 x 12	cfm	50	60	70	80	90	100	110
	Pressure	0.20	0.30	0.40	0.52	0.66	0.80	1.0
72 x 12	cfm	59	80	100	120	140	160	180
	Pressure	0.11	0.20	0.31	0.45	0.60	0.80	1.0
24 x 24	cfm	90	110	130	150	170	190	205
	Pressure	0.20	0.30	0.41	0.55	0.70	0.90	1.0
36 x 24	cfm	160	200	240	280	300	340	380
	Pressure	0.175	0.28	0.40	0.54	0.62	0.80	1.0
48 x 24	cfm	200	300	360	400	430	480	520
	Pressure	0.15	0.34	0.50	0.62	0.70	0.90	1.0
60 x 24	cfm	400	450	500	550	600	650	700
	Pressure	0.29	0.37	0.47	0.59	0.70	0.80	1.0
72 x 24	cfm	300	400	500	600	700	800	900
	Pressure	0.11	0.20	0.31	0.45	0.60	0.80	1.0
48 x 36	cfm	400	500	600	700	800	900	1000
	Pressure	0.16	0.25	0.35	0.50	0.64	0.80	1.0

- 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.

Critical Environment Diffusers | Application Notes

Application Notes ●●●

Titus Operating Room Air Distribution System

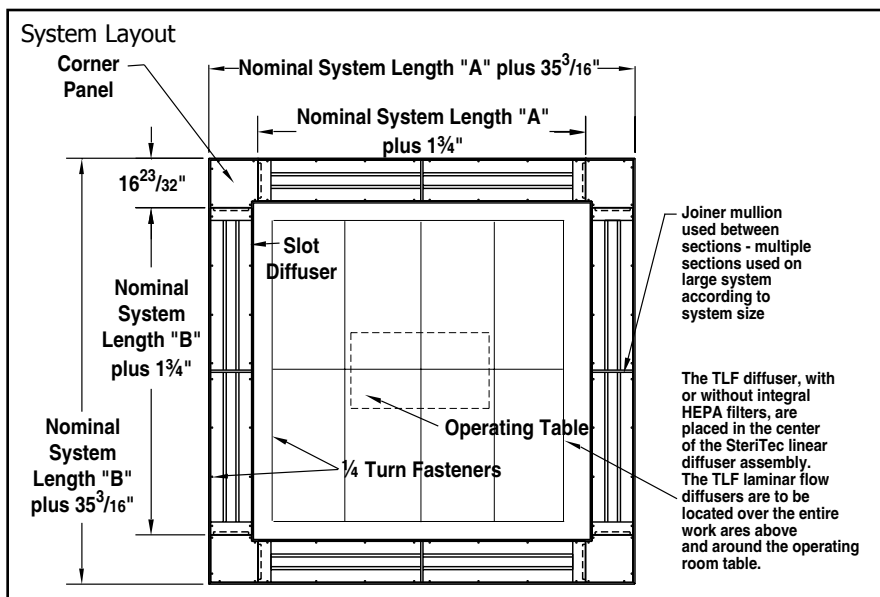
System Sizing and Layout

System Calculations Steps:

1. Determine room size.
2. Determine desired number of air changes 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 D28 for more details.) Most operating rooms are now recommended to be designed at a minimum 25 air changes per hour (ACPH). The new guidelines do not state this airflow be all outside airflow. The airflow should be highly 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.

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 D30 for Plenum Inlet Location diagrams.
 **cfm for 30 fpm see D26
 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 _____.

Critical Environment Diffusers | Application Notes

Application Notes (continued)

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 checks possible contaminants 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.

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.

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. Supply air velocity to the interior diffusers and the exterior air curtain should be within 5 percent of each other.

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.



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