

**TAD Series**

This series of radial face, critical room supply diffusers offer 90° or 180° air patterns. Available in aluminum or stainless steel construction. A HEPA filter backpan model is also available.



**Radiaflo™ Series**

This series of flush face, radial critical room supply diffusers offer a 180° air pattern. Available in aluminum or stainless steel construction. A HEPA filter backpan model is also available.



**Steriflo®**

Steriflo® is a stainless steel operating room system consisting of center and perimeter panels yielding exceptional particulate control.



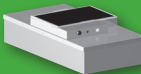
**Steriflex™**

Steriflex™ is a modular, aluminum operating room system consisting of center and perimeter panels yielding exceptional particulate control.



**5000, 5000HF**

The 5000 series are low velocity, non-aspirating, perforated laminar flow panels with aluminum, stainless steel, and cold rolled steel construction. A HEPA filter backpan model is also available.



**CRFF Series**

The CRFF series of critical room fan filter units feature PSC or ECM motors and multiple filter options.

**TAD, TADSS, TADHF, TADSSHF, TAD Backpan**

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## Introduction: Sterilflex™

Sterilflex™ is a modular operating room particulate control air distribution system that provides the best performance in the industry. Constructed completely of aluminum, Sterilflex™ offers a well built, competitively priced product. Based on the performance of the Sterilflo® system, which is the still the only operating room particle control system ever tested in the operating room during actual surgery and has remained unchanged since 1967, the Sterilflex™ provides our air curtain's unique ability to draw contaminated particles from the sterile field, allowing it to meet the most stringent standard for microbiological air cleanliness.

With its unique Integra-grid ceiling frame system, Sterilflex™ integrates seamlessly and easily with conventional lay-in, hard ceiling grid system or a combination of the two. Additionally, the Integra-grid system allows the flexibility of either a 12" grid base, or a 300mm base to fit your design requirements.

The Integra-grid frame disjoins the face and plenum assemblies. This permits using dissimilar bare metals in the two assemblies with fewer worries about galvanic action. The Integra-grid frame also maximizes post-delivery reconfiguration of the plenum locations by allowing the plenums to be relocated or turned 180°.

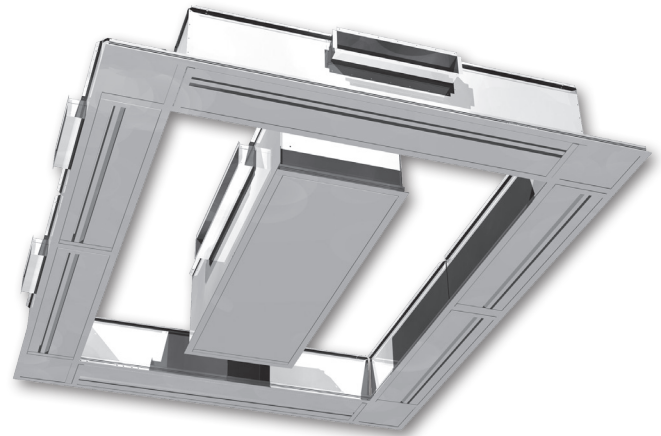
As is the case in most operating rooms, space of above the ceiling is limited, typically packed with surgical lights, gas drop and other supporting equipment. Krueger has integrated multiple inlet locations into the Sterilflex™ plenum design, offering you a choice of either side or top inlets. Additionally, with side inlets, you may also select left, center or right inlet positions.

### MODEL

Sterilflex™ - Modular Operating Room Particulate Control Air Distribution System, Aluminum Construction

### FEATURES

- Aluminum construction.
- Best-in-class performance with a modular design.
- Integra-grid ceiling frame insures a fast, accurate installation.
- Compatible with sheetrock and T-bar ceiling types.
- Left, center, and right side plenum inlet location.
- Top centered plenum inlet location (optional).
- Lay-in faces.
- Seismic restraints.



*Sterilflex™ Installed View*

## Sterilflex™ Principles of Operation

Air distribution systems for hospital operating rooms should be viewed as mere comfort condition devices unless they can provide particulate control. Systems capable of providing particulate control must provide for one or more of the four basic principles used to remove particles from the operative area. These are **extraction, dilution, suppression, and isolation.**

**Extraction** is simply the removal of particulate matter from the supply air before it enters the room. Presently, this is accomplished by means of HEPA (High Efficiency Particle Accumulator) filters. HEPA filters can be designed to remove 99.97% of particulates 0.3 microns or larger in size. This is certainly adequate for providing clean air into the room. However, it does not address the issue of some sizes of sub-micron particles, such as viruses, nor does it account for particulates produced by the surgical staff or by the procedure itself. These must be accounted for by the remaining three principles.

**Dilution** is a critical requirement. The introduction of large amounts of HEPA filtered air into the room flushes contaminated air from the space rapidly, rather than leaving them suspended in the space; thus, allowing several opportunities for particles to reach the wound area of the patient. The Sterilflex™ System, with its air curtain, multiplies the effect of the dilution factor much the same way as the plastic curtain or “greenhouse” once did. For all intents and purposes, the Sterilflex™ air curtain creates a room within the operating room. All air enters the operating room within the boundaries of that air curtained cube and is forced out of the cube into the remainder of the room where it exits through the exhaust or return grilles. While the air change rates in a typical operating room may be 20 per hour, inside the cube, the air change rates can be several times that!

Best of all, the air curtain does not represent a physical barrier to the surgical staff; thus, assuring them of the ability to do their work unimpeded.

**Suppression** can be defined as the enforced directional movement of particulate matter away from the wound area. Typically, this is accomplished with laminar diffusers that are designed to provide unidirectional air movement without entraining room air. In the Sterilflex™ System, the air curtain enhances the function of specially designed laminar flow panels. The curtain and panels utilize a pressure differential plus the induction and entrainment of the laminar air to provide positive movement of particulate matter downward and outward from the operative field. This permits suppression far superior to laminar devices alone.

**Isolation** requires that the critical area where least particulate matter is desired must be maintained at the highest positive pressure relative to its surroundings. Standard design criteria require that the pressure in an operating room be at least .05” of water gage higher than the surrounding substerile corridors, scrub rooms, etc. Again, the air curtain of the Sterilflex™ System enhances this effect. Since all air in the room enters through its cube, it creates a room-within-a-room effect providing higher pressure within the cube relative to the surrounding space. This not only provides double the protection from particles entering from areas outside the operating room, but also protects from particles generated within the room by personnel and equipment outside the unit’s protective barrier.

The unique combination of these principles, available only from the Sterilflex™ System, provides significant reductions in particulate matter in the operative field which reduces the potential for nosocomial infections incurred during the procedure.

## Perforated Panel System vs. Sterilflex™ System

For perforated panel systems (laminar flow diffusers) to assist in contamination control, it would be necessary to have an unbroken array of panels over and around the operating table to provide a solid mass of air down and around the patient and members of the surgical team. This is rarely, if ever, possible for several reasons.

- 1) Perforated panel distribution must be maintained at very low CFM per square foot levels in order to reduce drafts, noise, and pressure drop. This requires a large square footage of panel area to provide the air change rates required by code.
- 2) Surgical lighting must be provided at fixed locations in the ceiling in order to provide for optimum focus and lumen levels. To provide maximum benefit to the surgeon, these locations must be maintained.
- 3) Gas track or columns, IV hooks, and other such devices must often occupy the ceiling space in an operating room.

As a result of the listed requirements, the normal configuration of the perforated panels are split into groups to accommodate ceiling locations for other components: surgical lights, etc. This results in multiple air streams over and around the patients and surgical team. Since these are multiple air streams, rather than a single unbroken stream, turbulence is increased, as is the possibility of infectious organisms migrating into this turbulent flow.

Alternately, the Sterilflex™ System isolates contaminated air between the actual operating area and the walls of the operating room impinges upon, but cannot penetrate, the curtain of sterile air and is exhausted through the return air system. At the same time, the patient and surgical team are bathed in a constant flow of clean air from the center panels.

## Sterilflex™ Design Criteria

1. Determine the room CFM based on one of the following criteria:
  - A. Required air change rates
  - B. Load calculation
  - C. Maximum flow required for rapid cool down cycle (cardio procedures)
2. If room CFM is based on criterion A or B above, find on the accompanying table the Sterilflex™ System with mid-range CFM nearest to room CFM. Alterations should be based on the criteria that CFM per linear foot of perimeter plenum and square foot of center plenum shall fall between 25 minimum and 45 maximum. The CFM per linear foot of perimeter plenum and square foot of center plenum should be approximately the same.
3. If room CFM is based on criterion C above, find on the accompanying table the Sterilflex™ System with maximum CFM nearest to cool down mode CFM. Verify that normal flows do not fall below the minimum CFM of the system. Alterations should be based on the criteria that CFM per linear foot of perimeter plenum and square foot of center plenum shall fall between 25 minimum and 45 maximum. The CFM linear foot of perimeter plenum and square foot of center plenum should be approximately the same.
4. The standard height for a perimeter plenum is 12 3/4". The standard height for a center plenum is 18 13/16". This permits duct work from the center plenum to pass over the perimeter plenum.
5. Using the tables on the following pages, verify that the system design meets the needed NC levels and pressure drop.
6. System design is based on 9' 0" ceiling heights. For other ceiling heights, contact your local Krueger representative.
7. Verify if operating table is fixed or can be reoriented based on circumstances. It may be necessary to use a square system if the table orientation is variable.
8. Although the illustrations shown are representative 'standard' systems, all Sterilflex™ Systems are built to your specific order. Krueger will be happy to put its 40 years of hospital operating room experience to work for you and supply a suggested layout or submittal drawing from your reflected ceiling plans. Contact your local Krueger representative.

**Sterilflex™ Dimensional Information**

**STERILFLEX, CFM REFERENCE & DIMENSIONAL DETAILS**

Model	Perimeter Air Curtain				Center Laminar Panel			Min CFM	Max CFM	Mid-Range CFM
	W	L	A	B	C	D	QTY			
0408-1	4' 0"	8' 0"	6' 0"	10' 0"	2' 0"	6' 0"	1	900	1600	1300
0408-2					2' 0"	3' 0"	2			
0408-3					2' 0"	2' 0"	3			
0508-1	5' 0"	8' 0"	7' 0"	10' 0"	2' 0"	6' 0"	1	980	1760	1400
0508-2					2' 0"	3' 0"	2			
0508-3					2' 0"	2' 0"	3			
0410-1	4' 0"	10' 0"	6' 0"	12' 0"	2' 0"	6' 0"	1	1060	1900	1500
0410-2					2' 0"	3' 0"	2			
0410-3					2' 0"	2' 0"	3			
0608-1	6' 0"	8' 0"	8' 0"	10' 0"	2' 0"	6' 0"	1	1060	1900	1500
0608-2					2' 0"	3' 0"	2			
0608-3					2' 0"	2' 0"	3			
0510-1	5' 0"	10' 0"	7' 0"	12' 0"	2' 0"	6' 0"	1	1130	2030	1600
0510-2					2' 0"	4' 0"	2			
0510-3					2' 0"	3' 0"	3			
0610-2	6' 0"	10' 0"	8' 0"	12' 0"	2' 0"	5' 0"	2	1210	2170	1700
0610-3					2' 0"	3' 0"	3			
0610-4					2' 0"	2' 0"	4			
0808-2	8' 0"	8' 0"	10' 0"	10' 0"	2' 0"	4' 0"	2	1210	2170	1700
0808-3					2' 0"	3' 0"	3			
0808-4					2' 0"	2' 0"	4			
0512-2	5' 0"	12' 0"	7' 0"	14' 0"	2' 0"	4' 0"	2	1280	2300	1800
0512-3					2' 0"	3' 0"	3			
0512-4					2' 0"	2' 0"	4			
0612-2	6' 0"	12' 0"	8' 0"	14' 0"	2' 0"	5' 0"	2	1360	2440	1900
0612-3					2' 0"	3' 0"	3			
0612-4					2' 0"	2' 0"	4			
0810-2	8' 0"	10' 0"	10' 0"	12' 0"	2' 0"	4' 0"	2	1360	2440	1900
0810-3					2' 0"	3' 0"	3			
0810-4					2' 0"	2' 0"	4			
0812-2	8' 0"	12' 0"	10' 0"	14' 0"	2' 0"	5' 0"	2	1510	2710	2100
0812-3					2' 0"	3' 0"	3			
0812-4					1' 0"	5' 0"	4			
1010-2	10' 0"	10' 0"	12' 0"	12' 0"	2' 0"	5' 0"	2	1510	2710	2100
1010-3					2' 0"	3' 0"	3			
1010-4					1' 0"	5' 0"	4			
1012-2	10' 0"	12' 0"	12' 0"	14' 0"	2' 0"	6' 0"	2	1660	2980	2300
1012-3					2' 0"	4' 0"	3			
1012-4					2' 0"	3' 0"	4			
1014-2	10' 0"	14' 0"	12' 0"	16' 0"	2' 0"	6' 0"	2	1810	3250	2500
1014-3					2' 0"	4' 0"	3			
1014-4					2' 0"	3' 0"	4			
1212-2	12' 0"	12' 0"	14' 0"	14' 0"	2' 0"	6' 0"	2	1810	3250	2500
1212-3					2' 0"	4' 0"	3			
1212-4					2' 0"	3' 0"	4			
1016-2	10' 0"	16' 0"	12' 0"	18' 0"	2' 0"	6' 0"	2	1960	3520	2750
1016-3					2' 0"	4' 0"	3			
1016-4					2' 0"	3' 0"	4			
1214-2	12' 0"	14' 0"	14' 0"	16' 0"	2' 0"	6' 0"	2	1960	3520	2750
1214-3					2' 0"	4' 0"	3			
1214-4					2' 0"	3' 0"	4			
1216-3	12' 0"	16' 0"	14' 0"	18' 0"	2' 0"	5' 0"	3	2110	3790	2950
1216-4					2' 0"	4' 0"	4			
1414-3	14' 0"	14' 0"	16' 0"	16' 0"	2' 0"	5' 0"	3	2110	3790	2950
1414-4					2' 0"	4' 0"	4			

NOTE: Sizes refer to dimensional drawings on the next page.

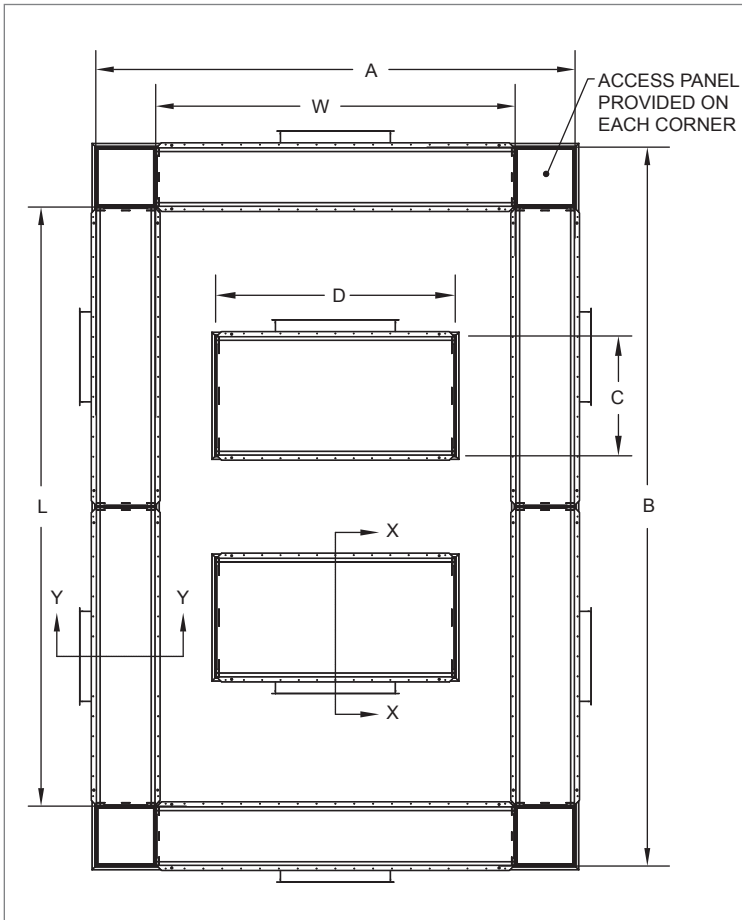
CRITICAL ROOM PRODUCTS

STERILFLEX

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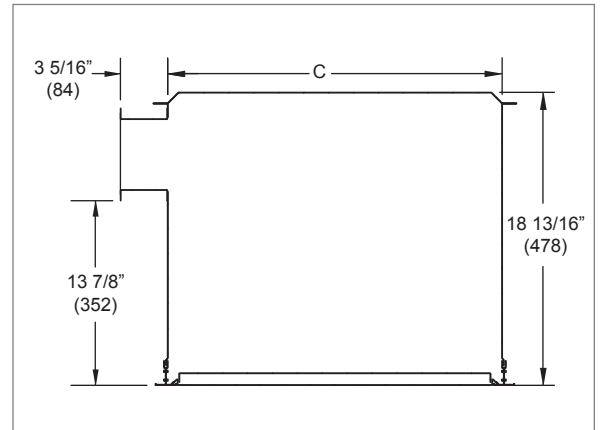
**Sterilflex™ Dimensional Information**

**STERILFLEX, TOP VIEW**

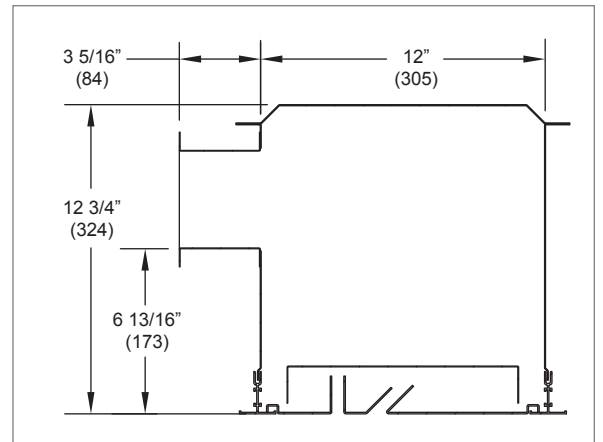


NOTE: Refer to page B3-41 for dimensional details.

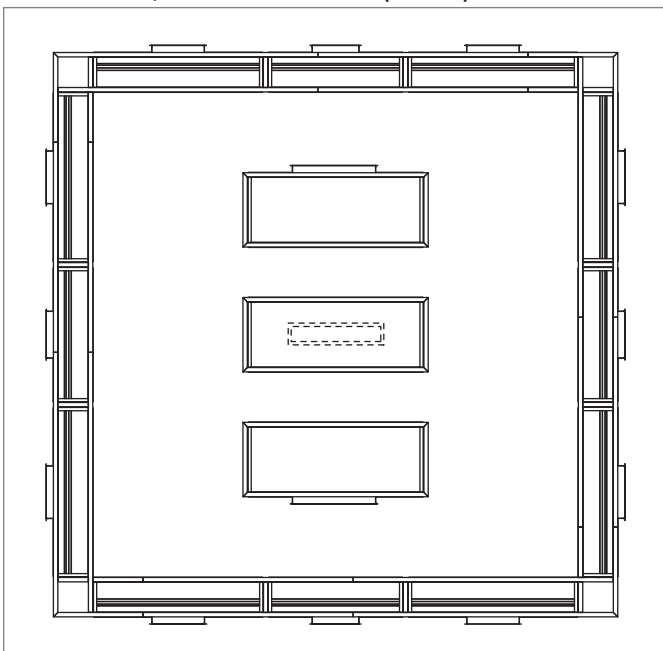
**STERILFLEX, CROSS SECTION CENTER (X-X)**



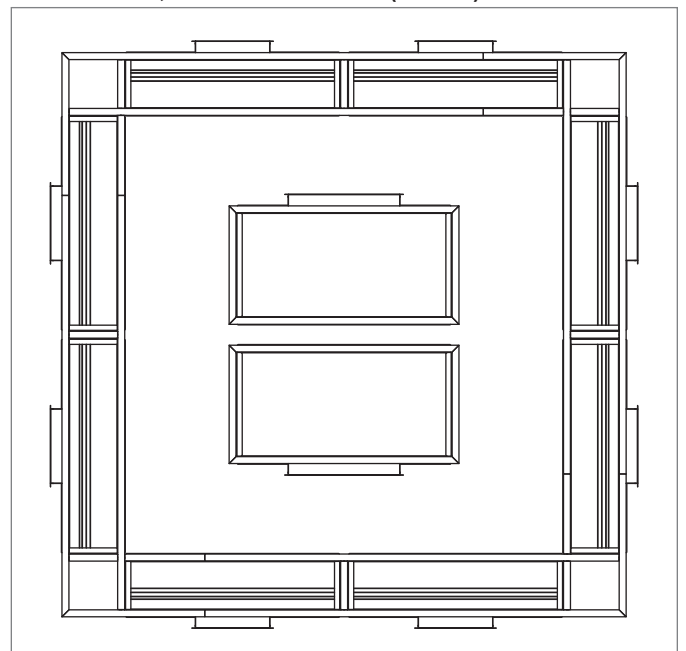
**STERILFLEX, CROSS SECTION PERIMETER (Y-Y)**



**STERILFLEX, TYPICAL LAYOUT (1414-3)**



**STERILFLEX, TYPICAL LAYOUT (0808-2)**



NOTE: Refer to page B3-41 for dimensional details.

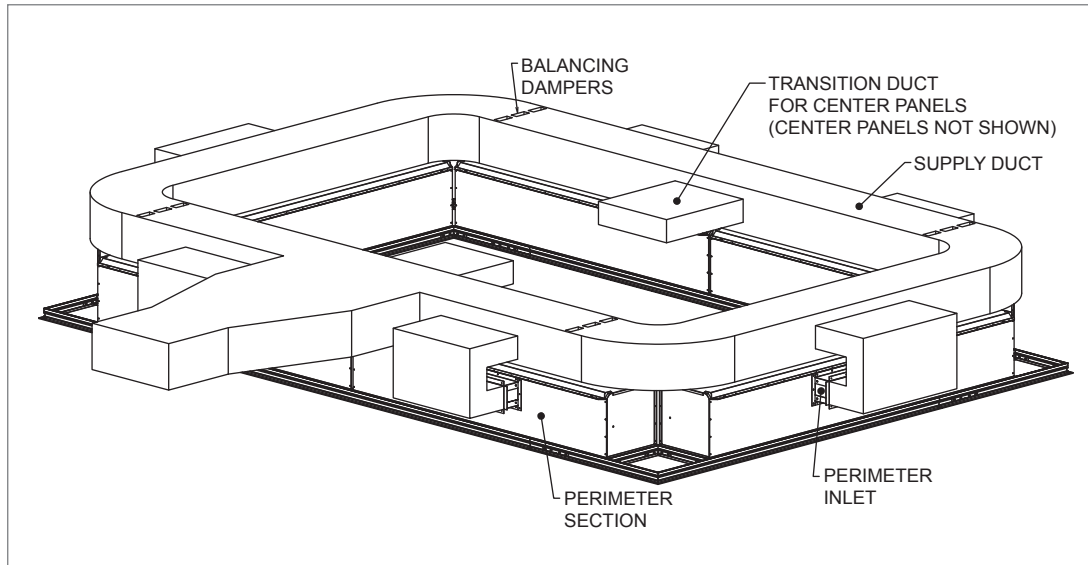
CRITICAL ROOM PRODUCTS

STERILFLEX

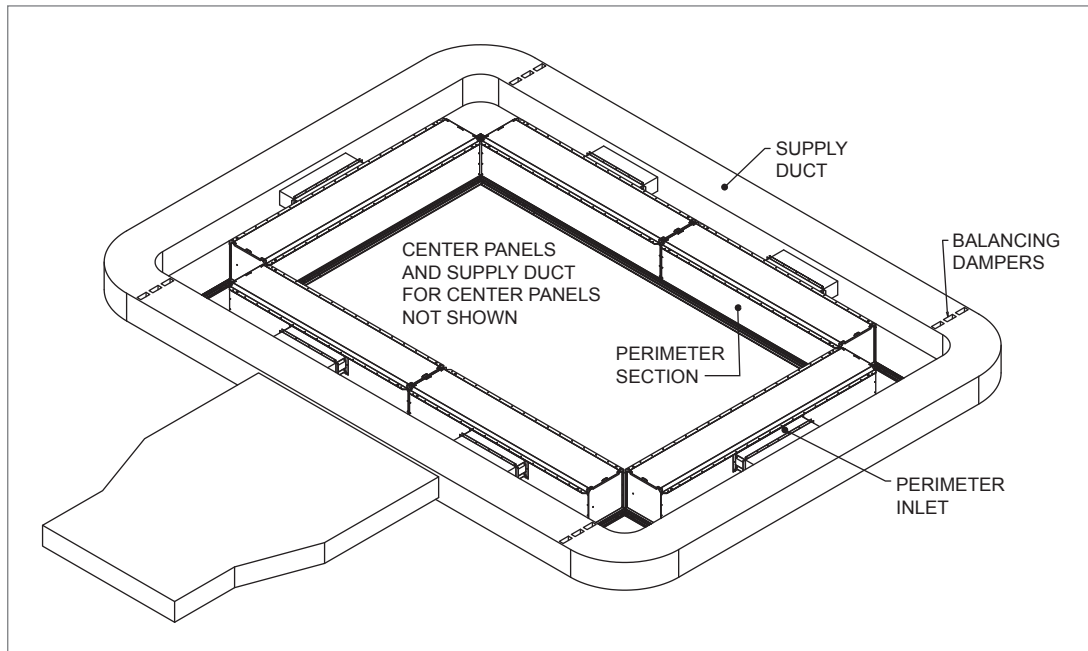
**Sterilflex™ Dimensional Information**

Detail 1 and 2 below show possible ways to layout the supply duct work. This layout helps accomplish two things. First, the donut-shaped ring helps facilitate system balancing. Placing dampers in the locations shown in the pictures below allows the entire system to be balanced without placing a damper at each inlet. This layout also minimizes the amount of duct work required. The second method (donut-shaped ring above the perimeter plenums) depicted in Detail 2 provides the above benefits while making it easier to supply the center laminar panels and reducing the space required for the donut.

**STERILFLEX, SYSTEM COMPONENT DETAIL 1**



**STERILFLEX, SYSTEM COMPONENT DETAIL 2**



CRITICAL ROOM PRODUCTS

STERILFLEX



## Sterilflex™ Performance Data

### STERILFLEX, STATIC PRESSURE REQUIREMENTS

Perimeter		Center	
CFM per Linear Foot of Plenum	Static Pressure Inches of Water Gage	CFM per Square Foot of Panel	Static Pressure Inches of Water Gage
20	0.016	20	0.042
25	0.024	25	0.065
30	0.034	30	0.093
35	0.046	35	0.125
40	0.060	40	0.165
45	0.075	45	0.205
50	0.092	50	0.250

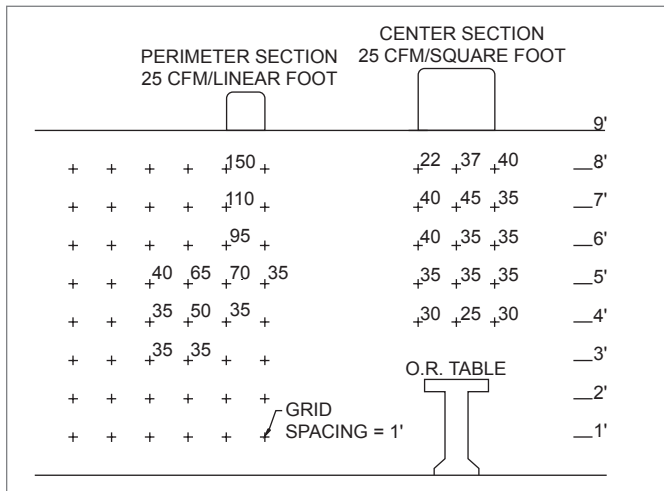
### STERILFLEX, NOISE CRITERIA

CFM per Linear Foot of Plenum	NC
20	12
25	18
30	23
35	28
43	32
45	35
50	39

NOTES: Static Pressure Requirements: Static pressure based on inlet velocities not exceeding 500 fpm. Noise Criteria: NC values are based on sound power levels minus a room absorption of 10dB, re 10<sup>-12</sup> Watts. Table is based on model 0408 with 24' linear perimeter. For each additional 4', add 1 NC. Table is based on perimeter panel only. In a properly designed system, the center panels will not add to total room NC.

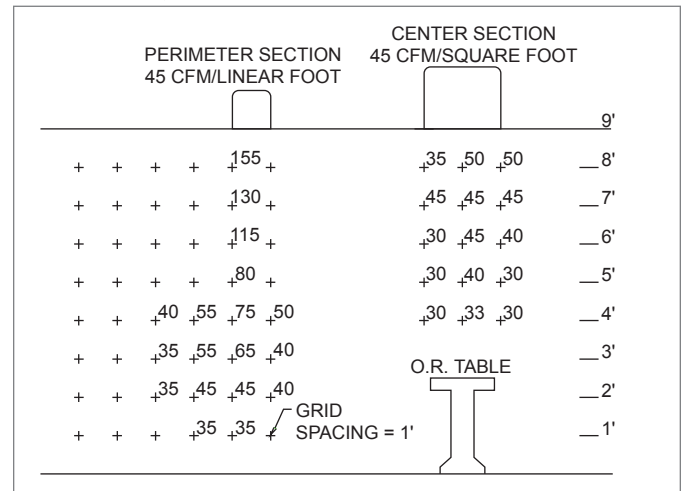
## Sterilflex™ Typical Application

### STERILFLEX, MINIMUM SUGGESTED AIRFLOW



NOTES: Velocity profiles in 1'x1' grid.

### STERILFLEX, MAXIMUM SUGGESTED AIRFLOW





**Sterilflex™ Suggested Specification****STERILFLEX™**

The air distribution and particulate control system(s) for the operating room(s) shall be the Sterilflex™ System by Krueger and consist of two interacting air distribution components: perimeter air curtain system and a center laminar system. The two elements must interact in a way that forms a complete system: the air curtain must serve to control the velocity profile of the laminar flow, extract particles from the sterile field, and act as a protective barrier against particles extracted from the sterile field, but still not exhausted from the space. Conversely, the laminar flow must be sufficient as to reach to, or slightly below, table level while not exceeding a velocity of 40 fpm at table level at design temperatures, and not impinging upon the curtain in a way that interferes with its function. Additionally, the two elements must interact in such a way as to create a slightly higher pressure zone in the sterile field with generalized air movement outward from that zone. This curtain will not be vertical, but rather project outward from the operating area at an angle of between 5° and 15°, with the greater angle occurring at isothermal conditions and the smaller angle at up to 20°F cooling. Both the center and perimeter panels shall include an internal method of equalizing air flow through the face.

The system shall have open corners to permit, if needed, the placement of gas or utility drops. If the open corner will not be utilized as such, it may be used to provide access to actuators for factory installed dampers. If not used for either purpose, the factory must provide the option for a panel that can be used to close the corner.

SFC (Center Laminar System)

The aluminum center panels must be completely separate and independent of the perimeter and shall exhibit an airflow that is substantial non-inducing (laminar). The center panels must install as either a standard surface mount, lay-in in a suspended ceiling, or lay-in in a special adapter frame mounted in a sheetrock ceiling. The manufacturer must be able to provide the center panel design as standard. The center plenums must be taller than the perimeter plenum to permit running duct work over the perimeter. If top inlets are used, the center plenums may be the same height as the perimeter.

SFP (Perimeter Air Curtain System)

The physical components of the perimeter system must be comprised of three distinct parts: a plenum device for introducing air from the duct work into the system, a face which provides the air motion control and a frame or similar device which holds the other two.

The aluminum frame must be completely painted where it contacts the face and frame so that there is reduced risk of galvanic action and capable of integration with either a sheetrock ceiling, a suspended ceiling, or both. Also, the frame must provide a pocket or channel that permits application of a caulk to seal the plenum and the frame. The frame must provide a basis for face installation without mechanical fasteners and be designed in such a way that the face cannot move more than .25" in any one direction.

The aluminum plenum must be designed to be rigid enough to resist distortion during normal installation processes and available with either side or top rectangular inlets sized so that the maximum required airflow through the inlet does not exceed 500 fpm. The plenum shall have an integral hanger bracket with holes for 1/4" hanger rods pre-punched at the factory. Mechanically fastened or welded hanger brackets are not acceptable. No individual plenum shall be greater than 72" in length. Each plenum module shall be self-contained with no open ends requiring fit up to another plenum section while maintaining identical construction and geometry and be interchangeable with a different plenum module of the same length, and shall be reversible, at installation. This allows for unit reconfiguration within allowable limits.

The aluminum face must be a lay-in design that does not depend on mechanical fasteners for security and not have any adjustable components. The slot arrangement on the face must be capable of introducing into the space a free jet that is neither predominantly horizontal or vertical, but somewhere between. The face may not utilize a laminar panel, as this will not provide sufficient velocity for particle extraction. Any individual face segment must not exceed 72" in length. Each face segment shall have a pair of safety cables to prevent unexpected removal of the face and be rigid enough to resist any distortion during installation.