

STERI-SYSTEM

- HOSPITAL OPERATING ROOM AIR SYSTEM
- STAINLESS STEEL CONSTRUCTION

Models:

92STSYS Stainless Steel

- Suffix '-O' adds perimeter inlet balancing dampers



Model 92STSYS

The **Nailor Steri-System** is a complete operating room ventilation system specially designed to reduce airborne contaminants, and thus, the risk of patient infection during surgery. By using directed airflow, a protective 'clean zone' is created around the patient. The system consists of two main components.

Model 92LS-SS Linear Slot Diffusers, located around the perimeter, create a continuous curtain of air angled outwards 5 – 15°. The curtain encloses the operating area and minimizes the possibility of contaminated air entering the surgical area. The single slot design creates a uniform low velocity curtain that minimizes entrainment of contaminated air into the curtain air stream. It also creates a wider velocity profile with less turbulence and hence less induction over similar two slot designs. The face design incorporates longitudinal deflectors that horizontally deflect a small amount of air lengthwise. This effectively joins the airflow through sections and corners forming a truly continuous air curtain, resulting in enhanced isolation of the surgical area.

Model 92LFD-SS Laminar Flow Diffusers, installed above the operating table, produce a low velocity, non-aspirating, vertical air pattern. This 'clean' conditioned air flows over the operating table protecting the patient while greatly increasing the ventilation rate within the surgical area. The unique design incorporates a second pressure plate as an integral assembly to ensure true laminar airflow.

The Steri-System is available in fourteen standard module sizes with a wide variety of custom variations that allow it to be tailored to suit almost any application or configuration.

FEATURES:

- All face plates and assemblies are removable for cleaning and are secured by 1/4 turn stainless steel fasteners.
- Safety cables are included as standard and prevent accidental dropping of the removable faces.
- Standard units are designed for both lay-in T-Bar ceiling systems and surface mount applications.

- Integral earthquake hanger tabs are standard.
- Laminar flow diffusers have integral dampers adjustable from the face of the diffuser.

Material:

Type 304 Stainless Steel construction.

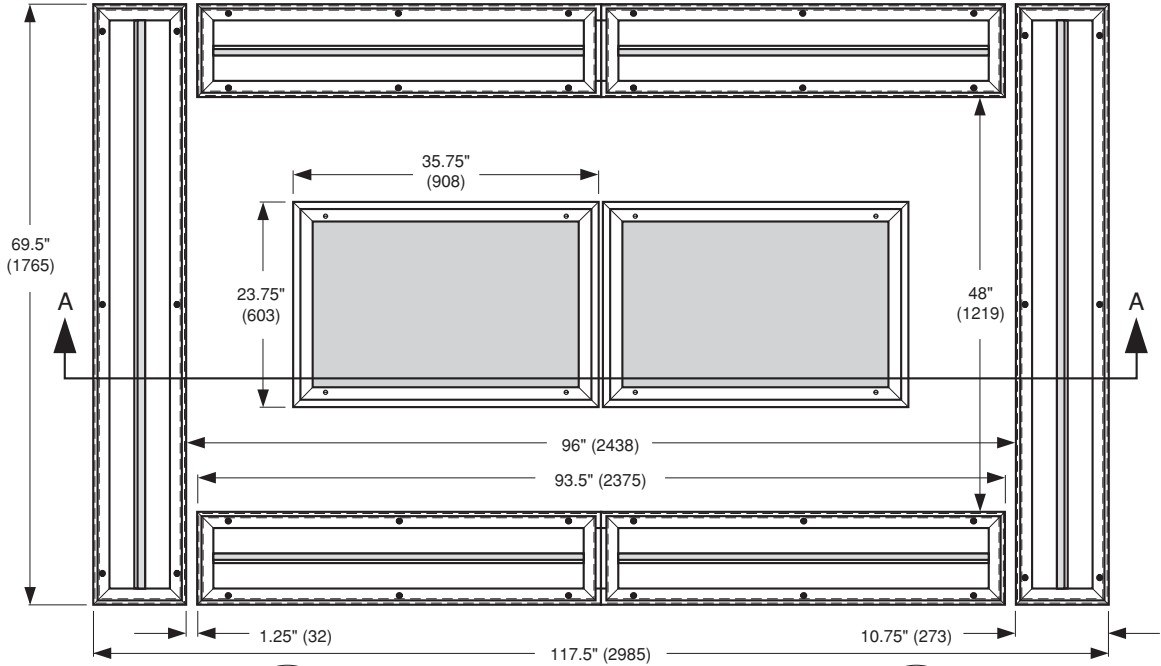
Finish: #3 Satin Polished finish is standard. Other finishes are available.

Options:

- Perimeter Inlet Balancing Dampers (Face operated and removable).
- 316 Stainless Steel construction.

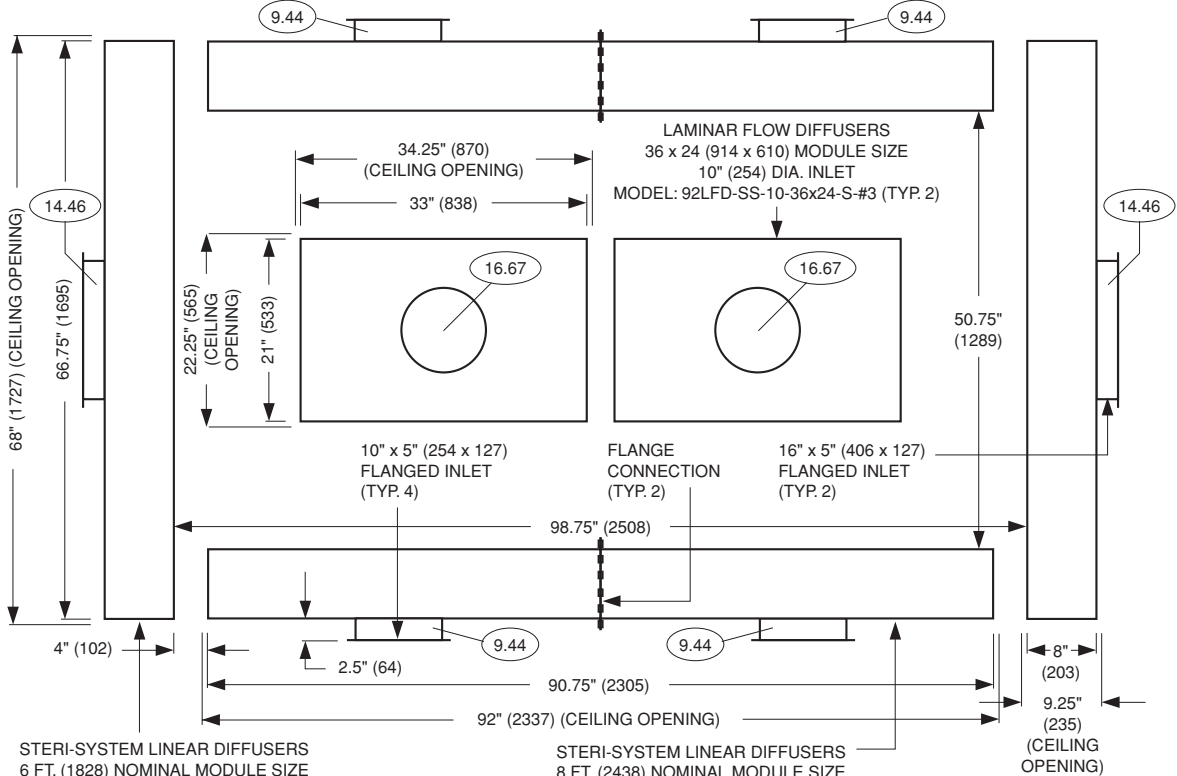
Dimensional Data • Steri-System 8 x 4 Module • Model: 92STSYS – 8 x 4

Reflected Ceiling View

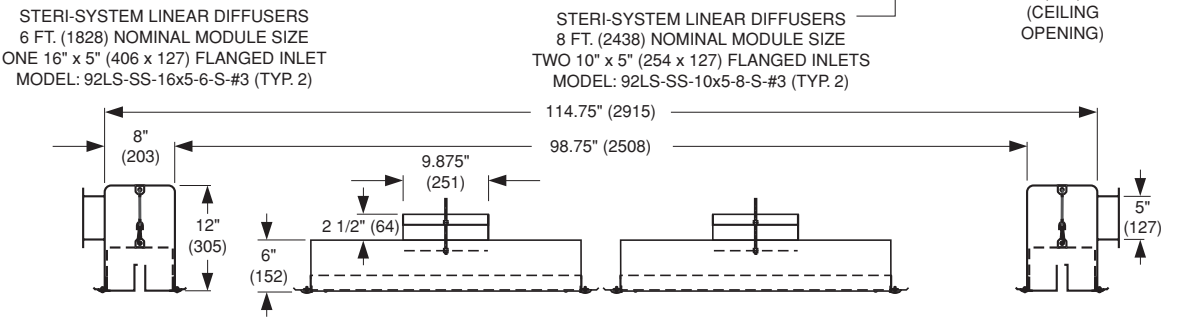


Plenum Top View

= RECOMMENDED PERCENTAGE OF TOTAL SYSTEM AIRFLOW SUPPLIED THROUGH IDENTIFIED INLET.

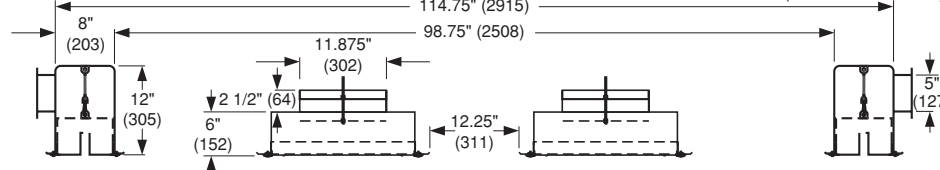
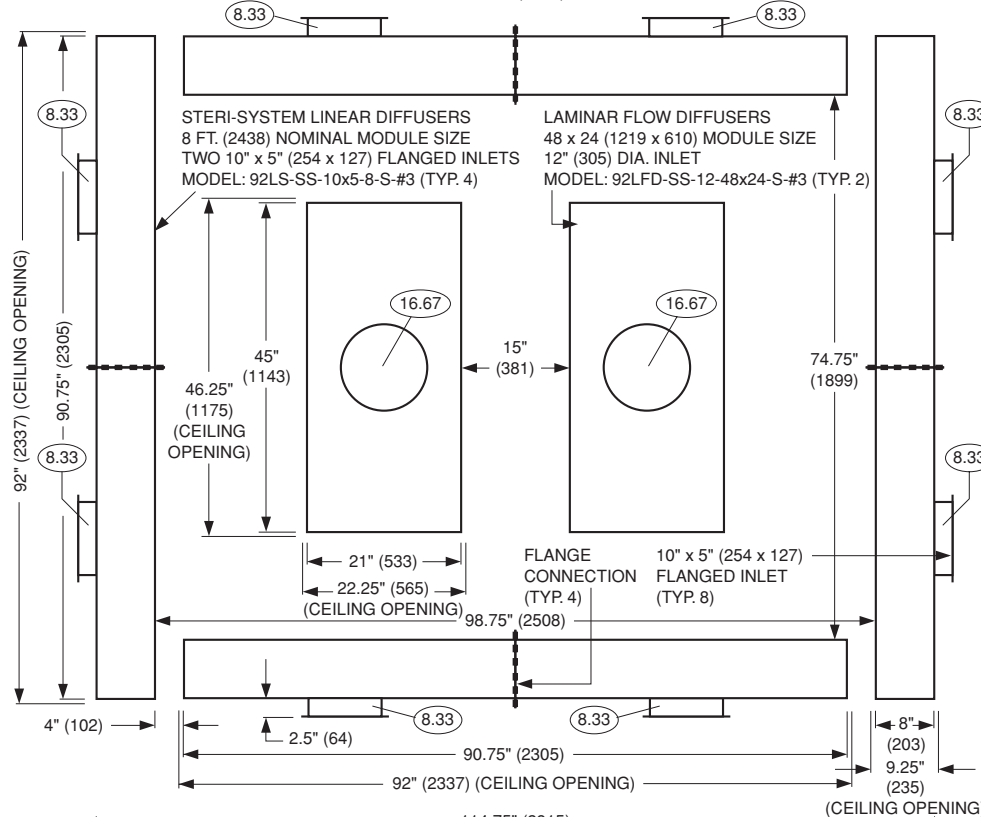
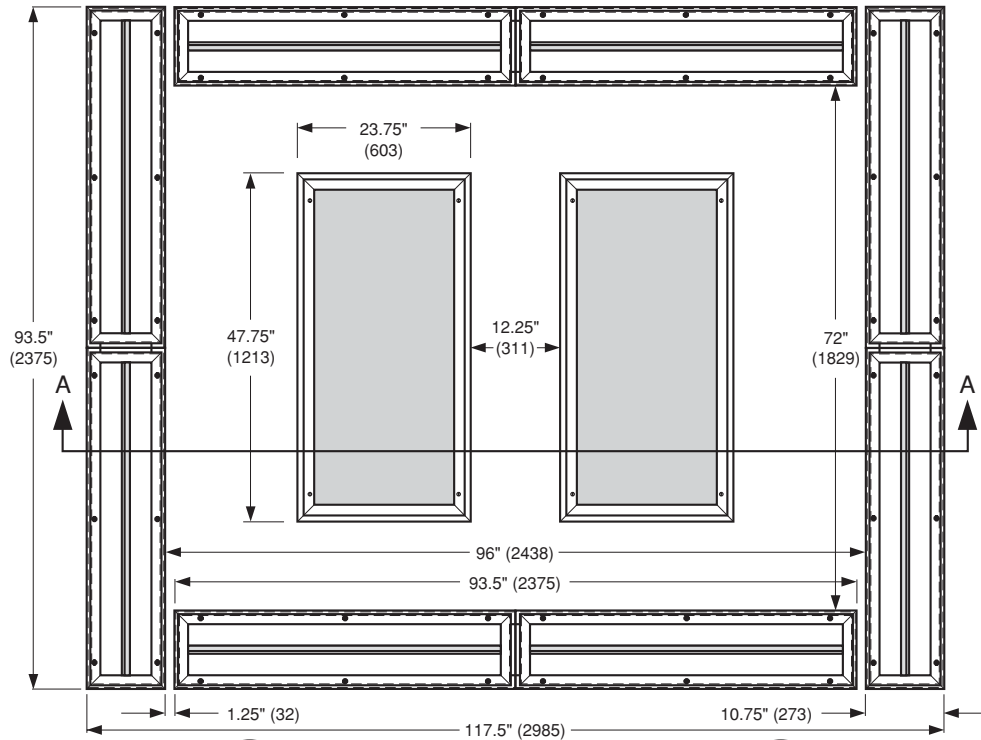


Section Detail A – A



HOSPITAL / CLEANROOM DIFFUSERS

Dimensional Data • Steri-System 8 x 6 Module • Model: 92STSYS – 8 x 6



Reflected Ceiling View

Plenum Top View

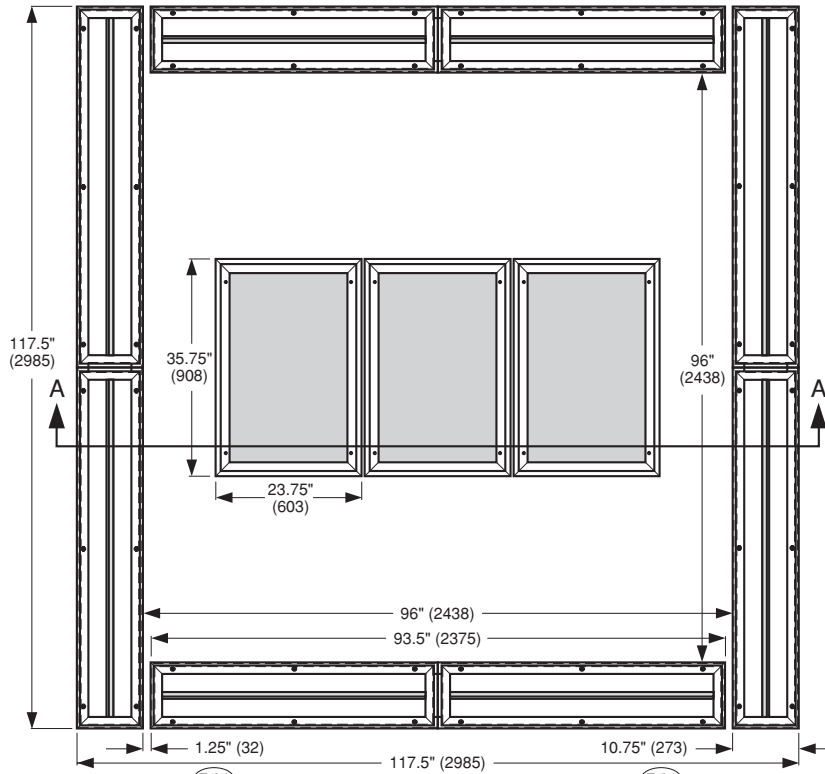
Section Detail A – A

= RECOMMENDED PERCENTAGE OF TOTAL SYSTEM AIRFLOW SUPPLIED THROUGH IDENTIFIED INLET.

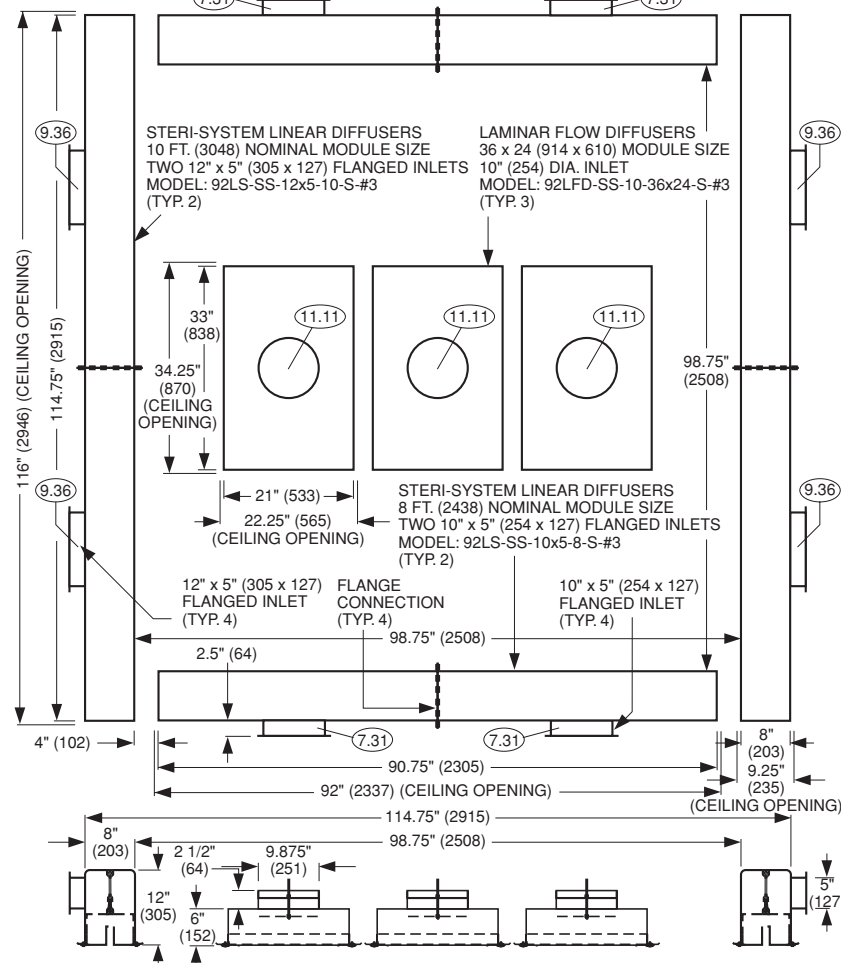
HOSPITAL / CLEANROOM DIFFUSERS

Dimensional Data • Steri-System 8 x 8 Module • Model: 92STSYS – 8 x 8

Reflected Ceiling View



Plenum Top View



RECOMMENDED PERCENTAGE OF TOTAL SYSTEM
AIRFLOW SUPPLIED THROUGH IDENTIFIED INLET.

#

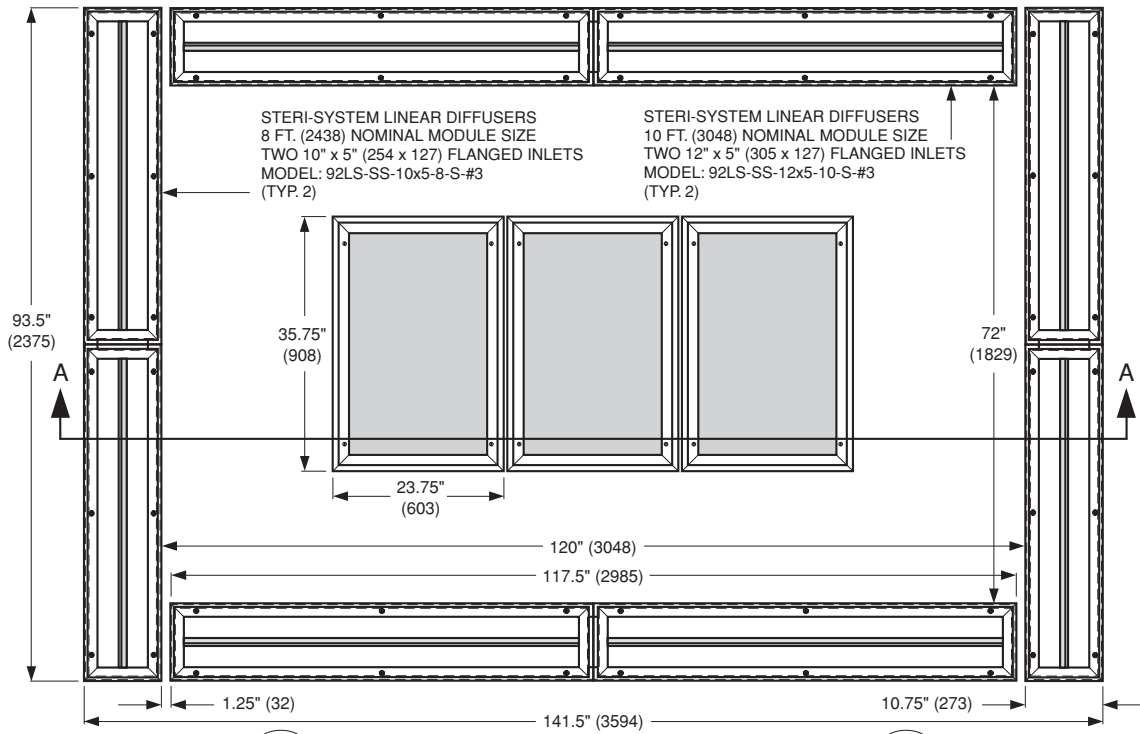
Section Detail A – A



HOSPITAL / CLEANROOM DIFFUSERS

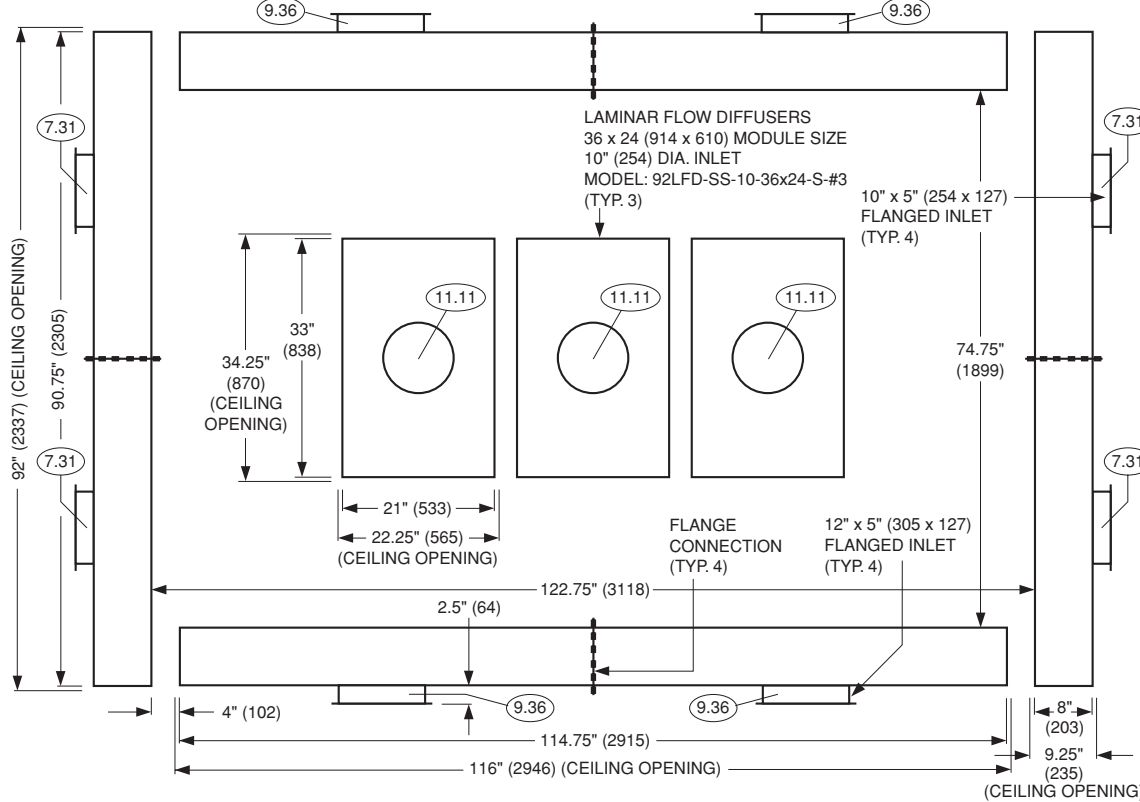
Dimensional Data • Steri-System 10 x 6 Module • Model: 92STSYS – 10 x 6

Reflected Ceiling View

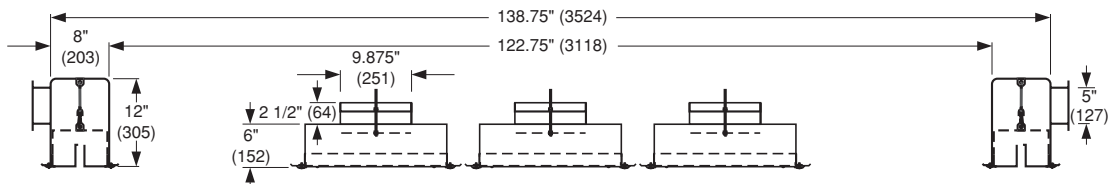


Plenum Top View

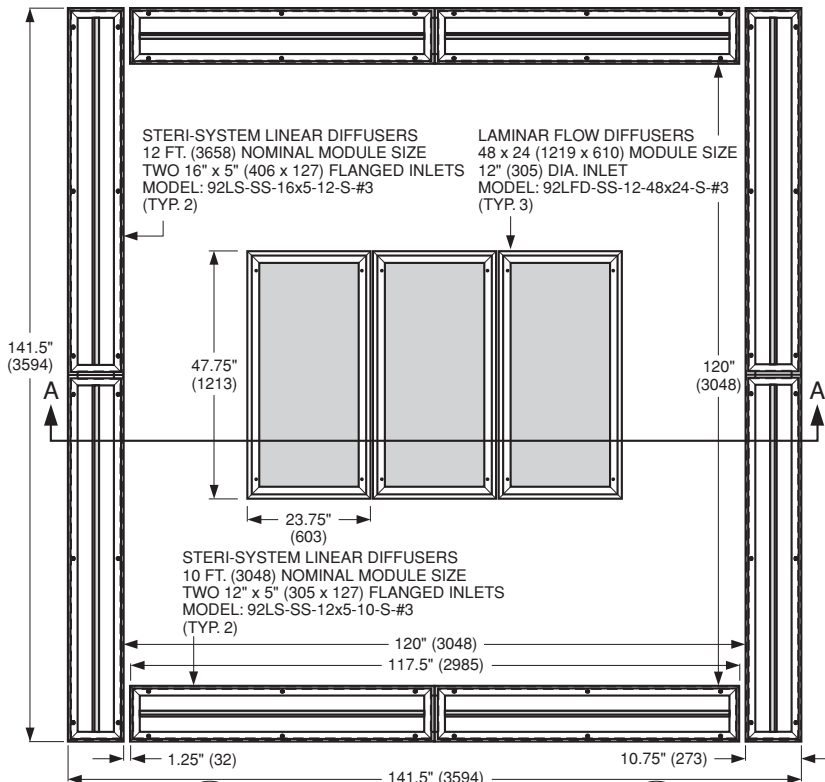
= RECOMMENDED PERCENTAGE OF TOTAL SYSTEM AIRFLOW SUPPLIED THROUGH IDENTIFIED INLET.



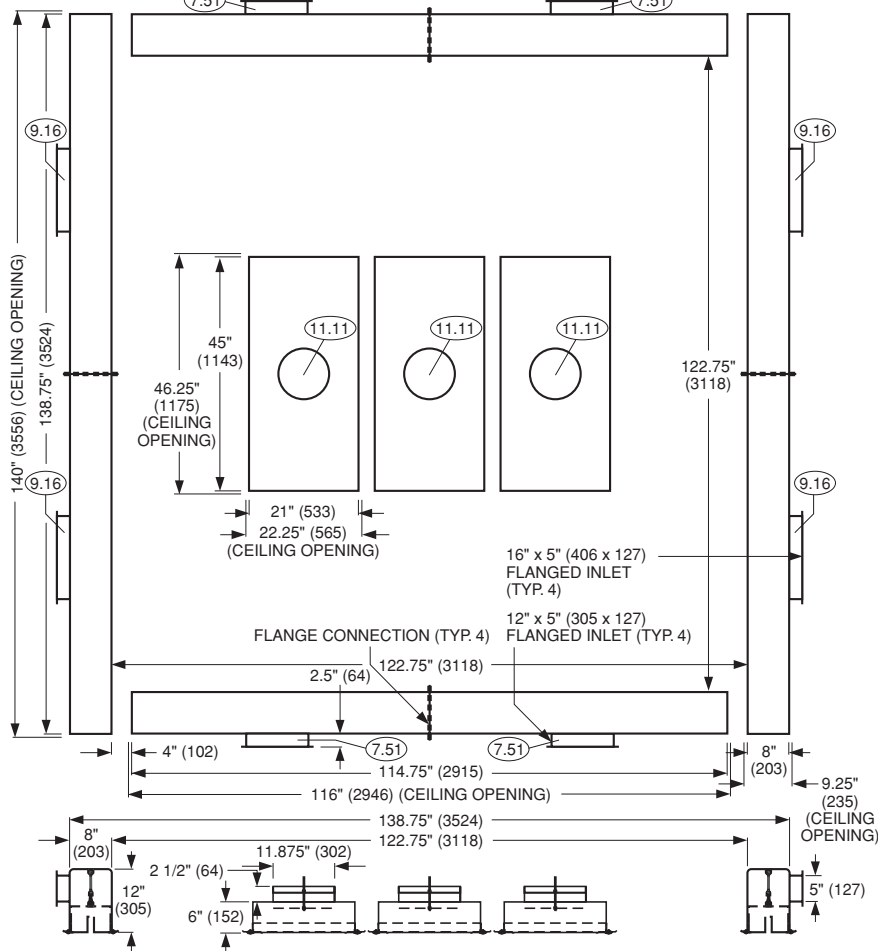
Section Detail A – A



Dimensional Data • Steri-System 10 x 10 Module • Model: 92STSYS – 10 x 10



Reflected Ceiling View

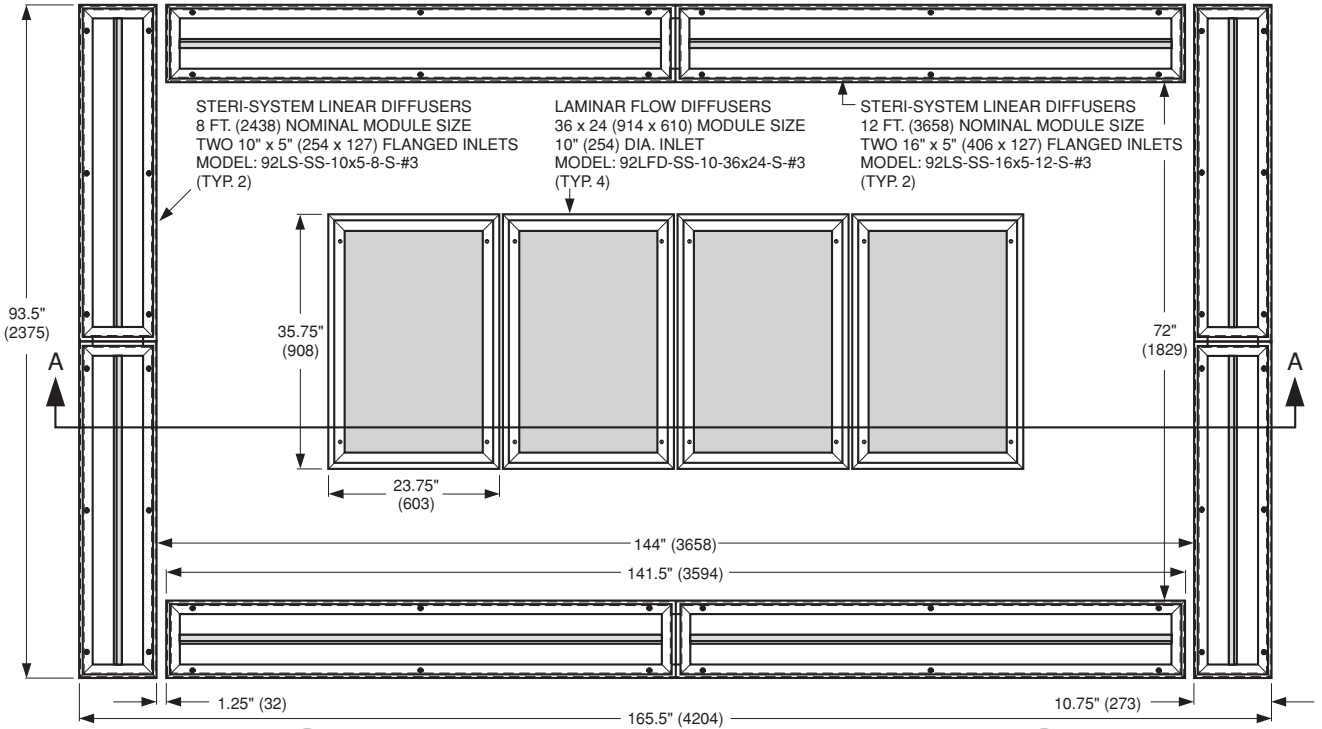


Plenum Top View

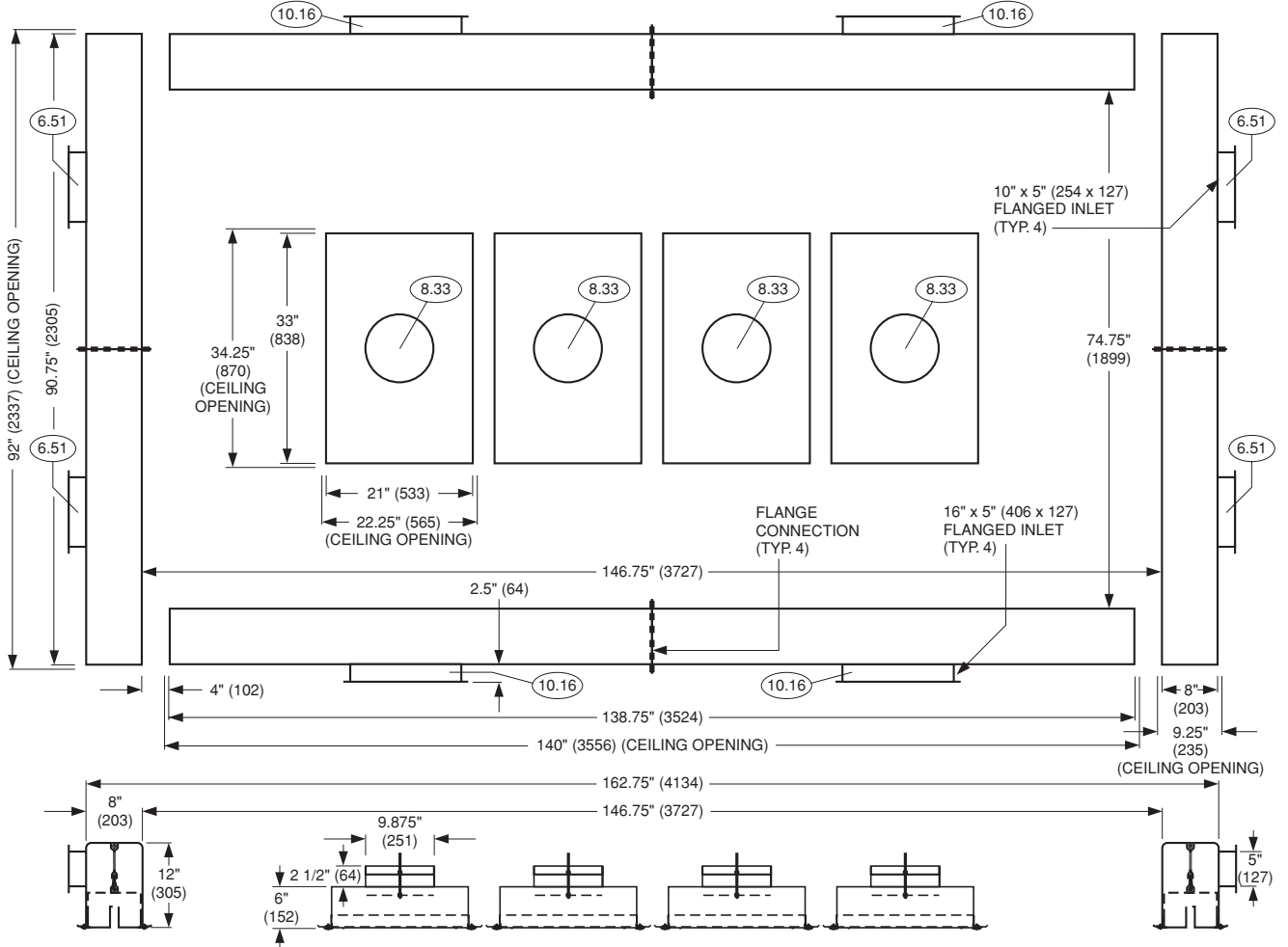
Section Detail A – A

Dimensional Data • Steri-System 12 x 6 Module • Model: 92STSYS – 12 x 6

Reflected Ceiling View



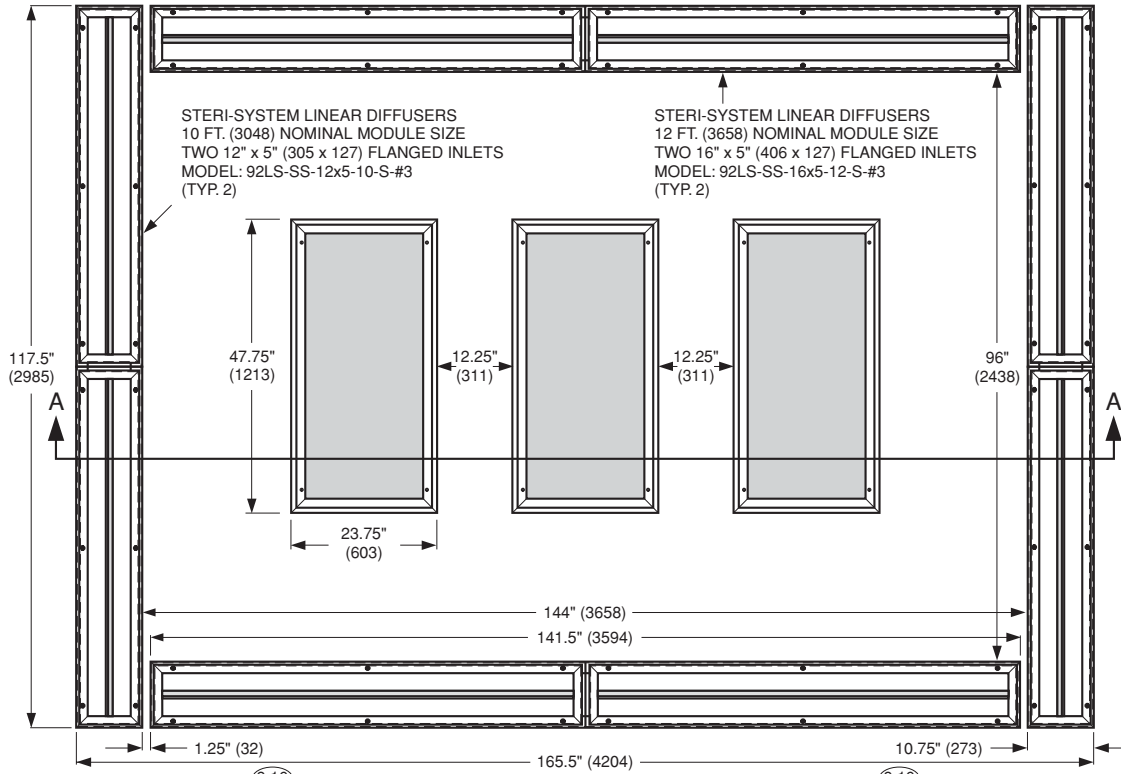
Section Detail A – A Plenum Top View



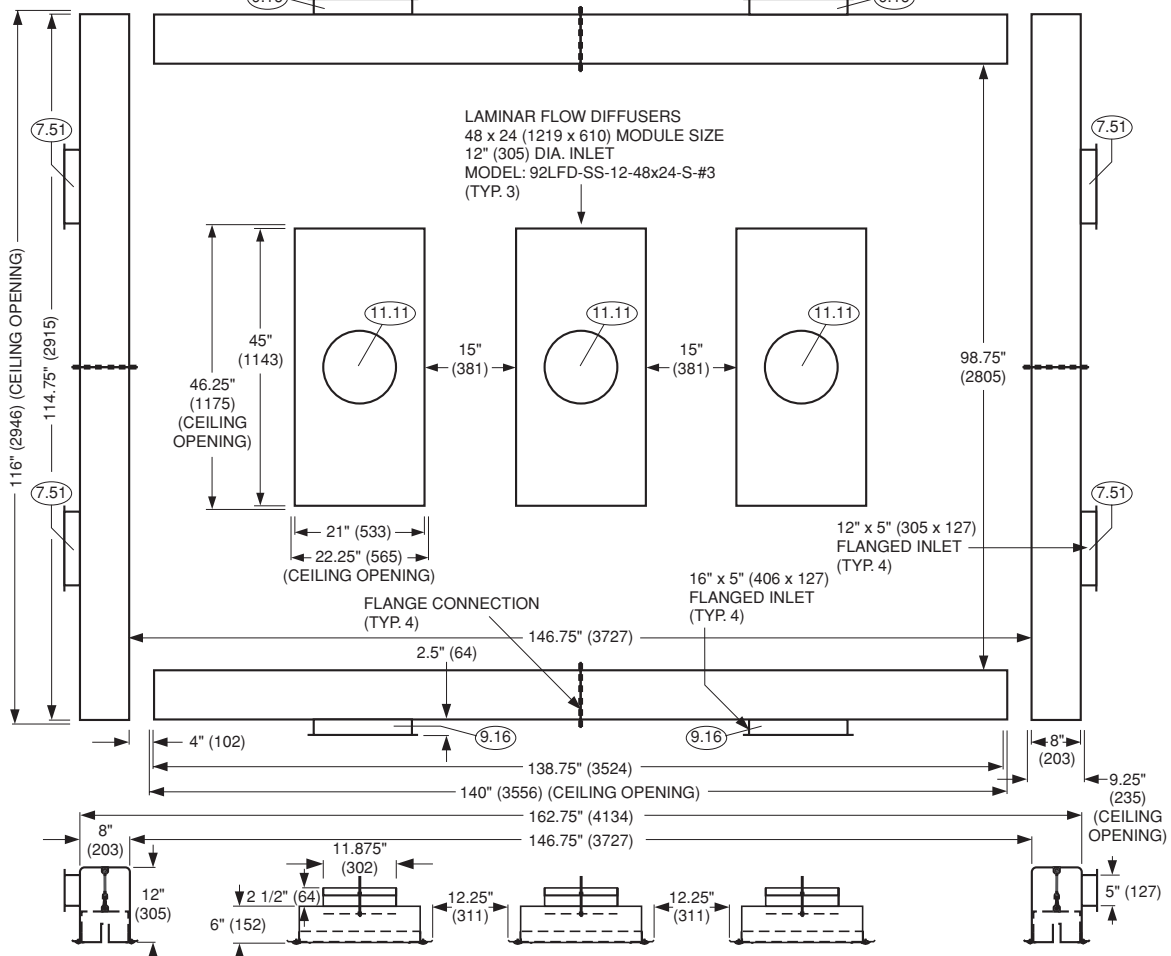
HOSPITAL / CLEANROOM DIFFUSERS

Dimensional Data • Steri-System 12 x 8 Module • Model: 92STSYS – 12 x 8

Reflected Ceiling View



Section Detail A – A Plenum Top View

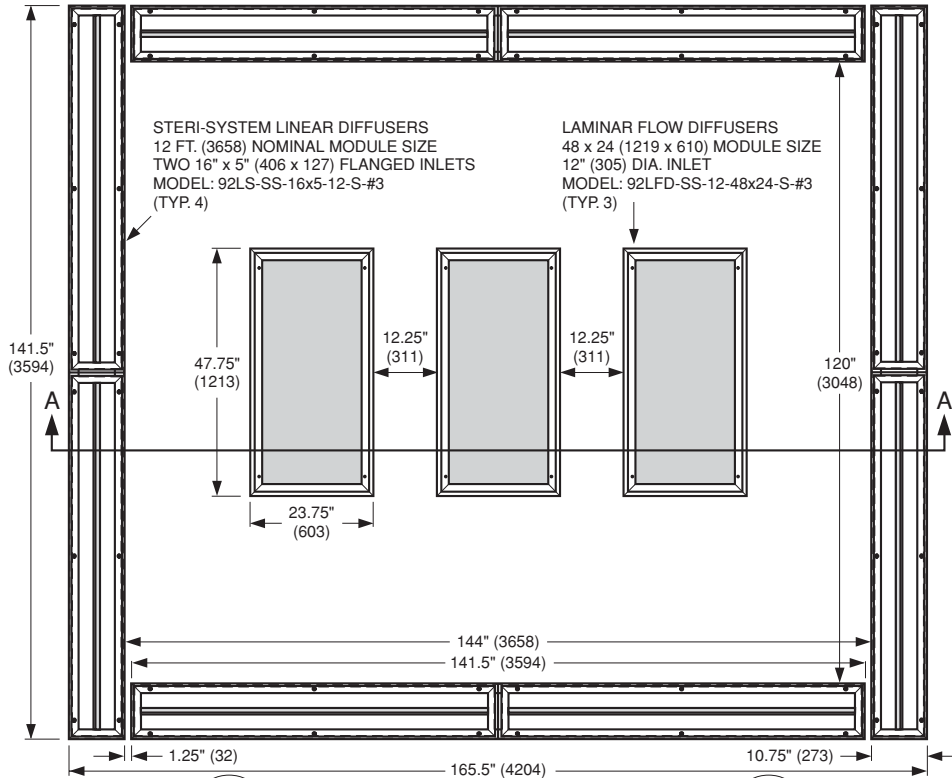


HOSPITAL / CLEANROOM DIFFUSERS

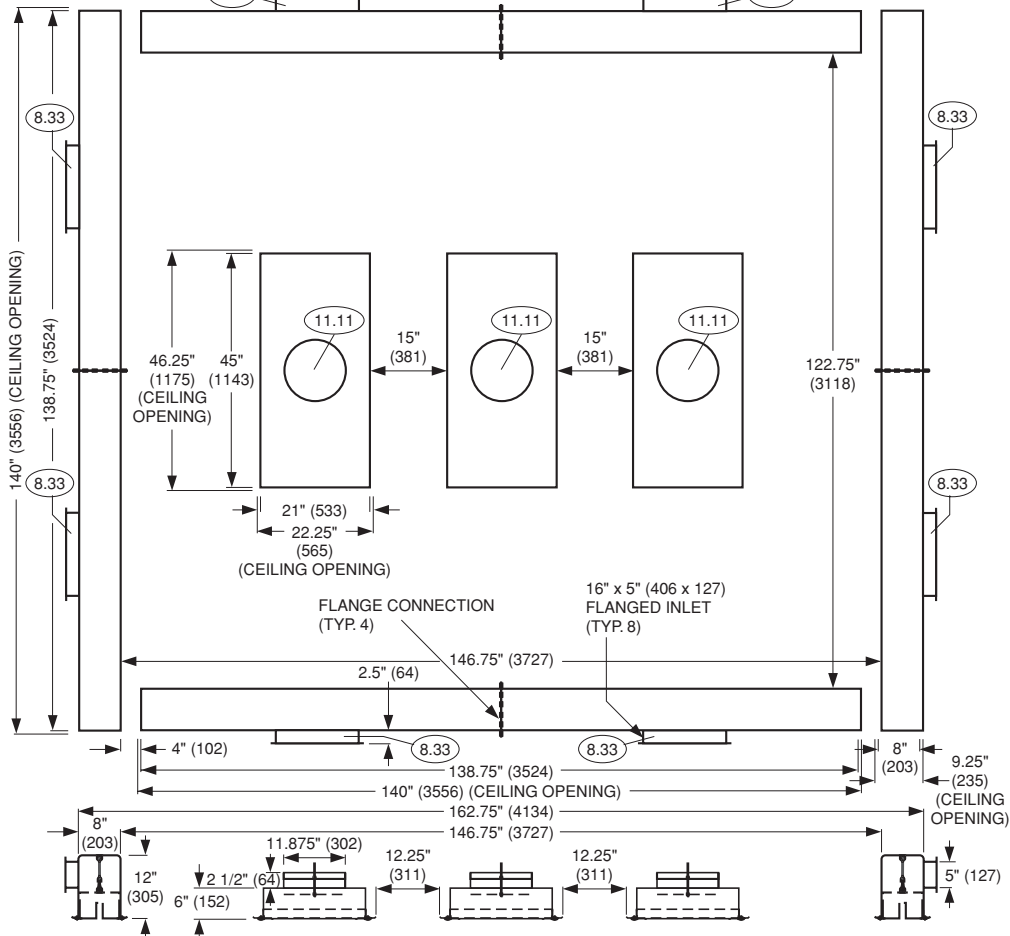
= RECOMMENDED PERCENTAGE OF TOTAL SYSTEM AIRFLOW SUPPLIED THROUGH IDENTIFIED INLET

Dimensional Data • Steri-System 12 x 10 Module • Model: 92STSYS – 12 x 10

Reflected Ceiling View

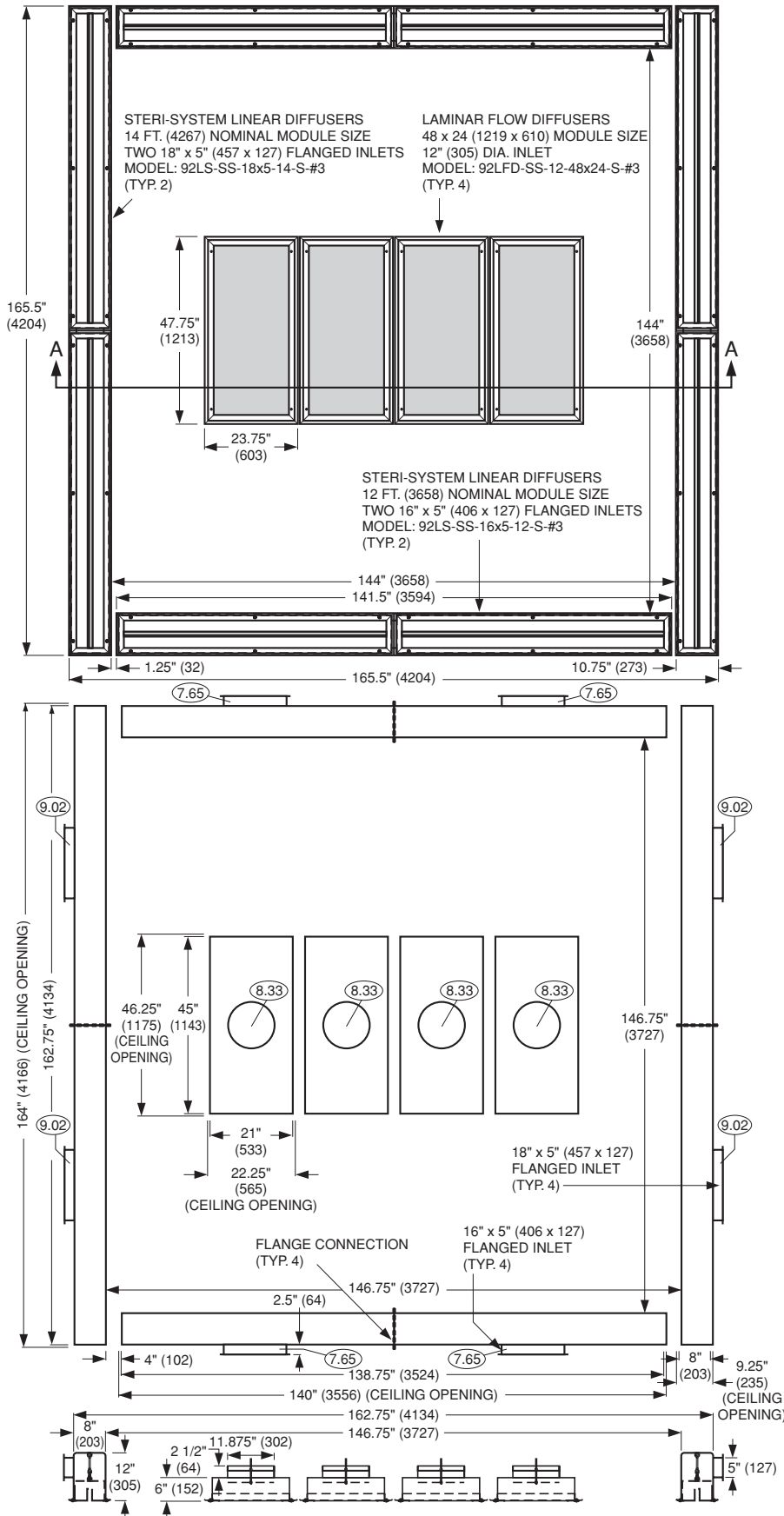


Plenum Top View



Section Detail A – A

Dimensional Data • Steri-System 12 x 12 Module • Model: 92STSYS – 12 x 12



HOSPITAL/CLEANROOM DIFFUSERS

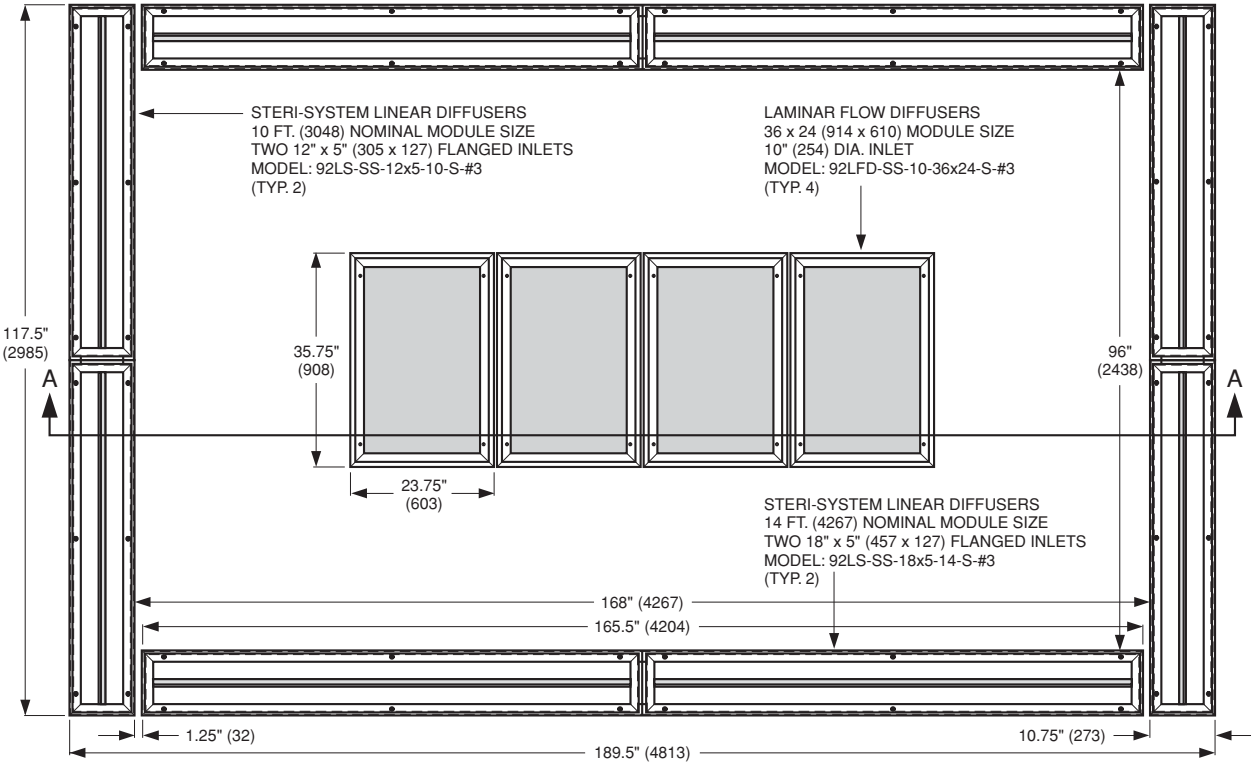
Reflected Ceiling View

Plenum Top View

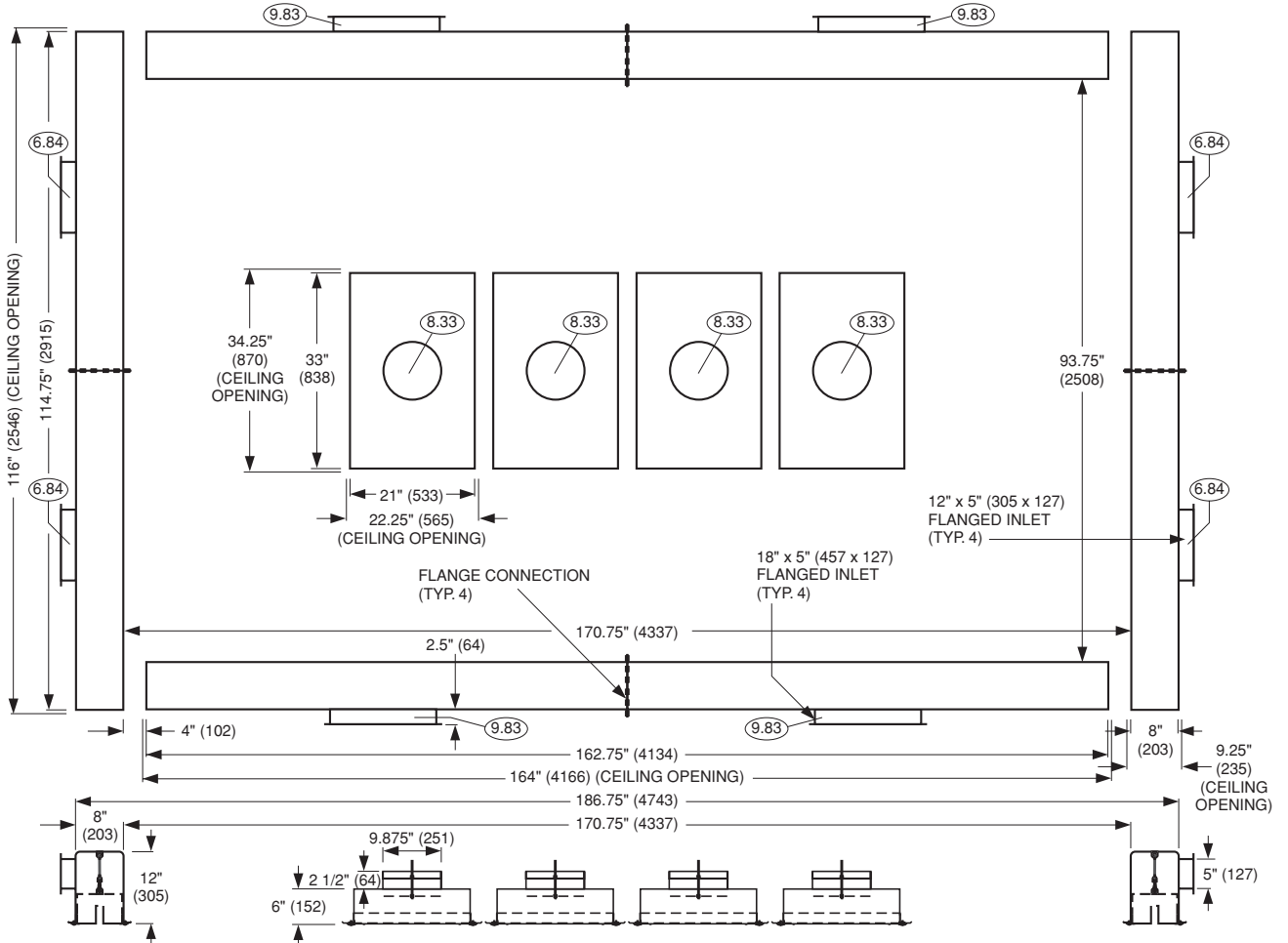
Section Detail A – A

Dimensional Data • Steri-System 14 x 8 Module • Model: 92STSYS – 14 x 8

Reflected Ceiling View



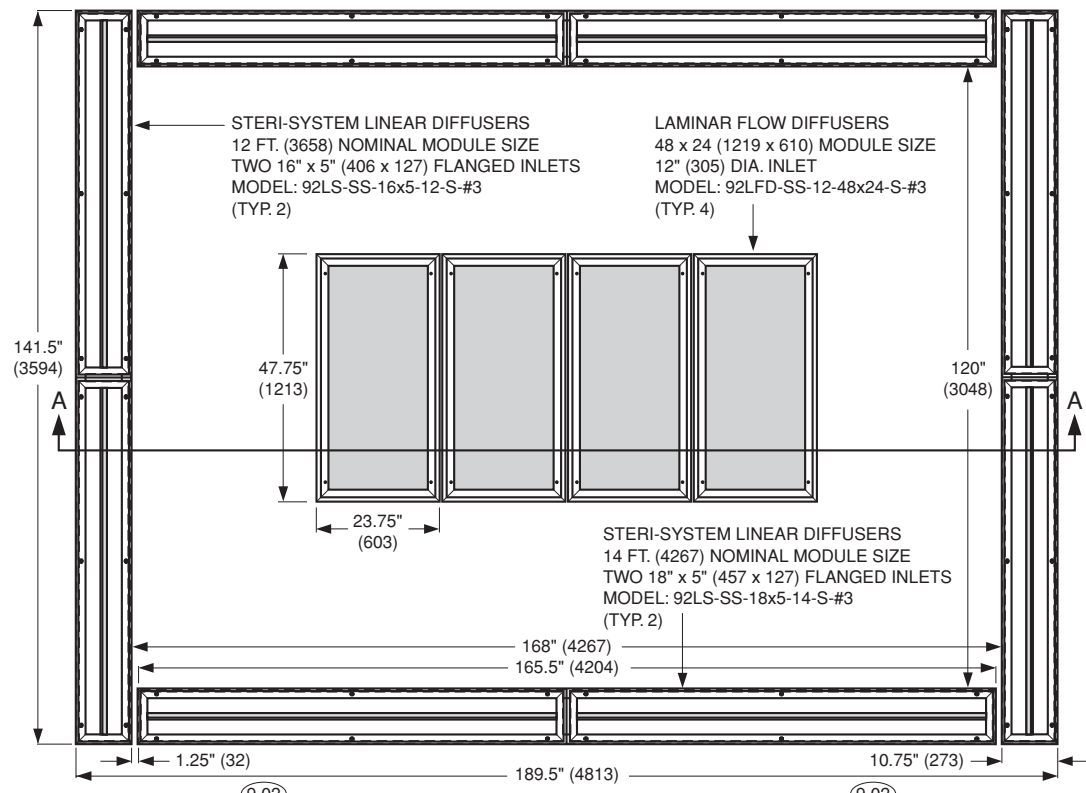
Section Detail A – A Plenum Top View



HOSPITAL / CLEANROOM DIFFUSERS

Dimensional Data • Steri-System 14 x 10 Module • Model: 92STSYS – 14 x 10

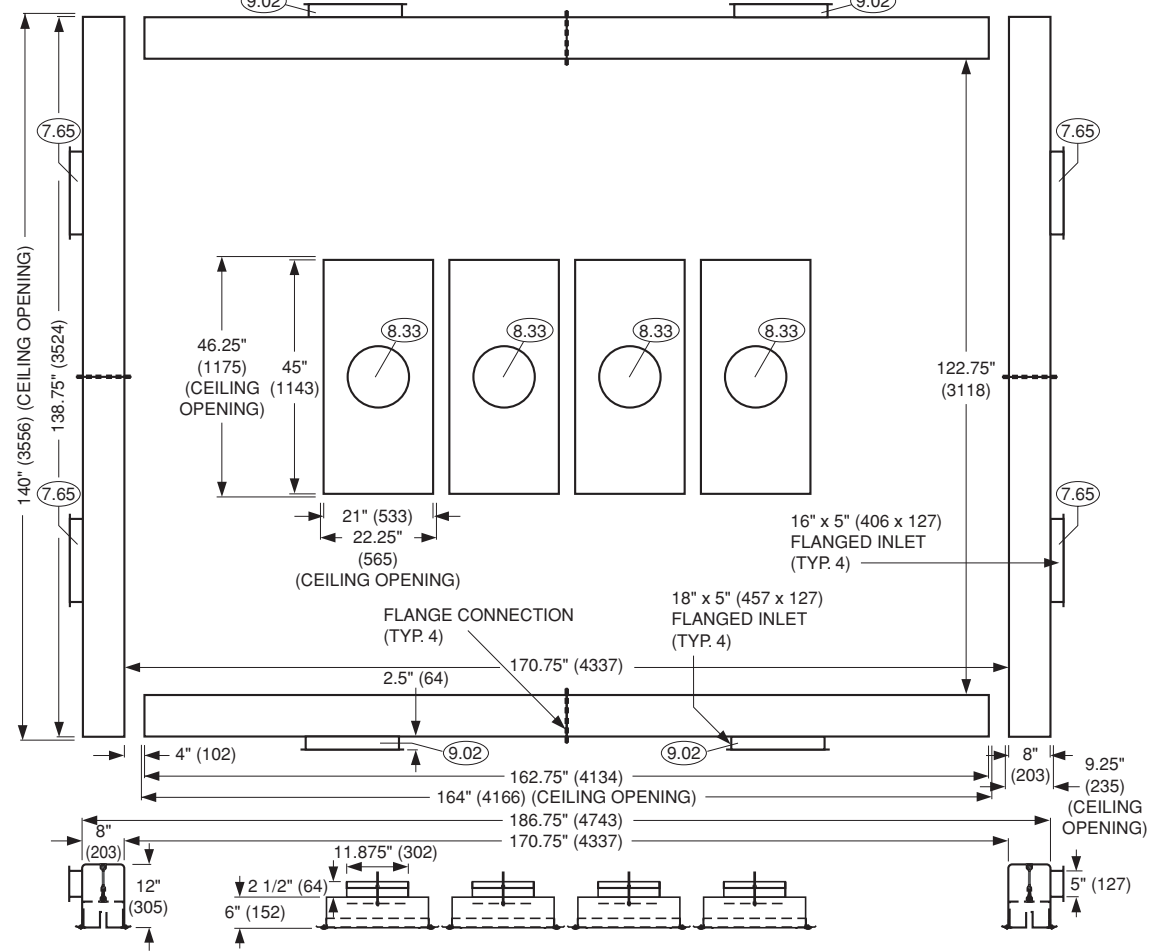
Reflected Ceiling View



HOSPITAL / CLEANROOM DIFFUSERS

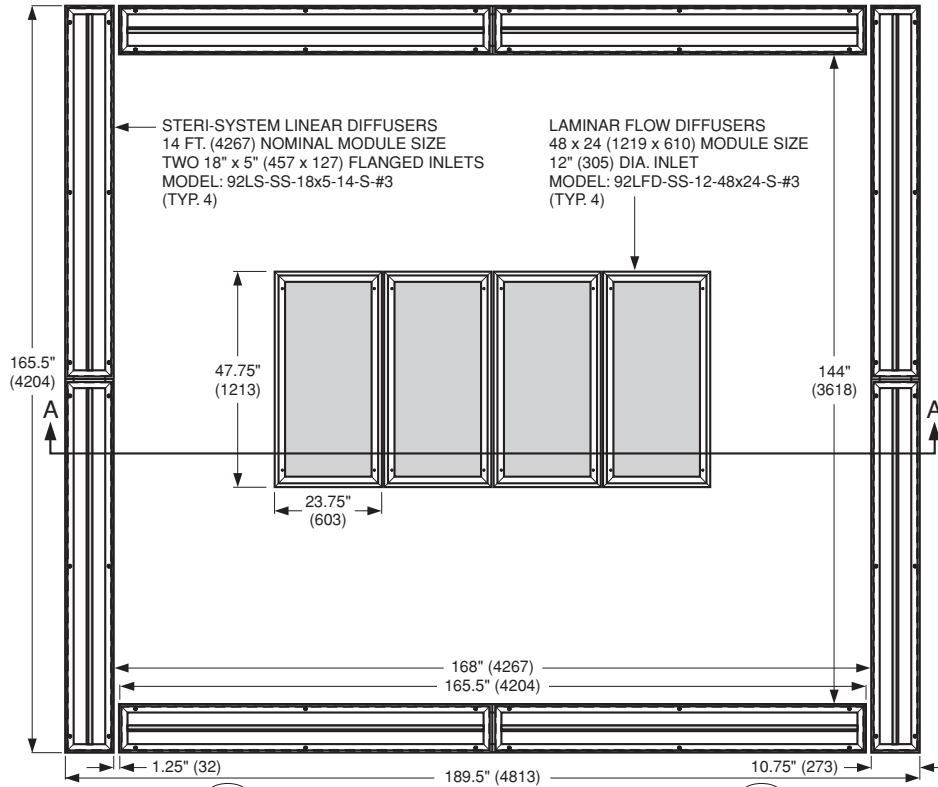
RECOMMENDED PERCENTAGE OF TOTAL SYSTEM AIRFLOW SUPPLIED THROUGH IDENTIFIED INLET

Section Detail A – A Plenum Top View

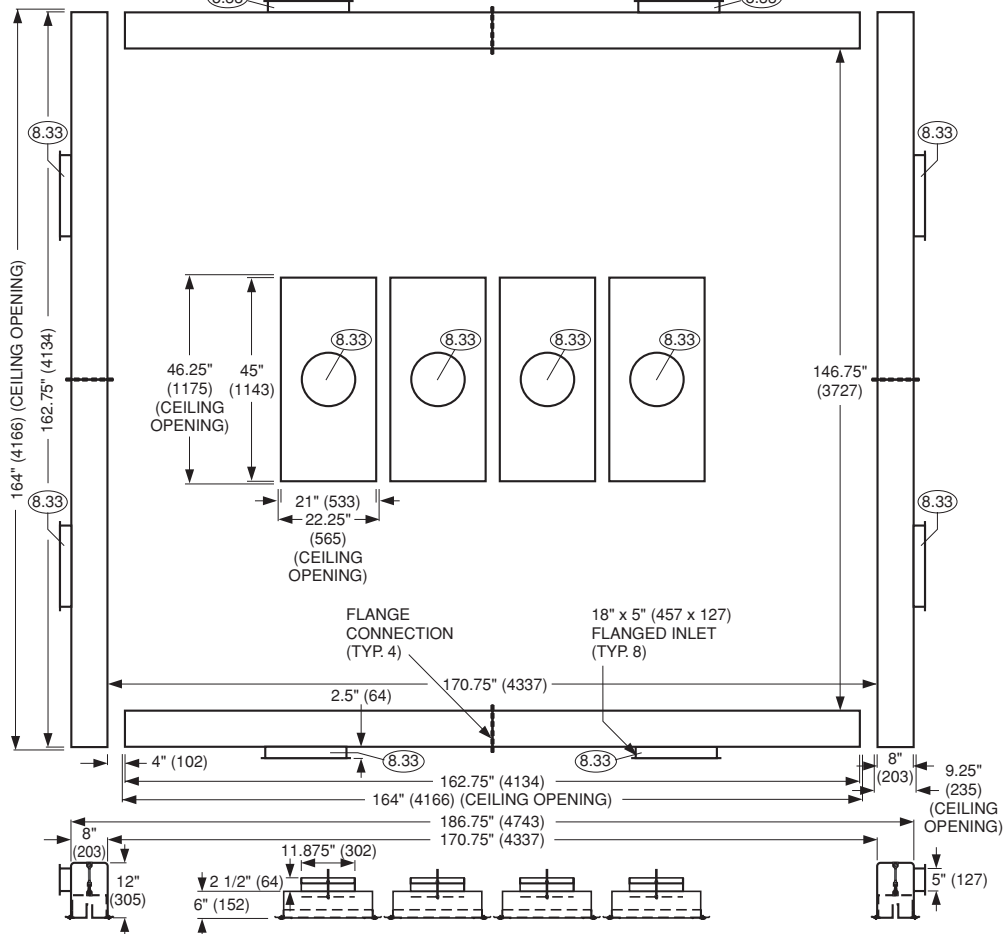


Dimensional Data • Steri-System 14 x 12 Module • Model: 92STSYS – 14 x 12

Reflected Ceiling View



Plenum Top View



Section Detail A – A

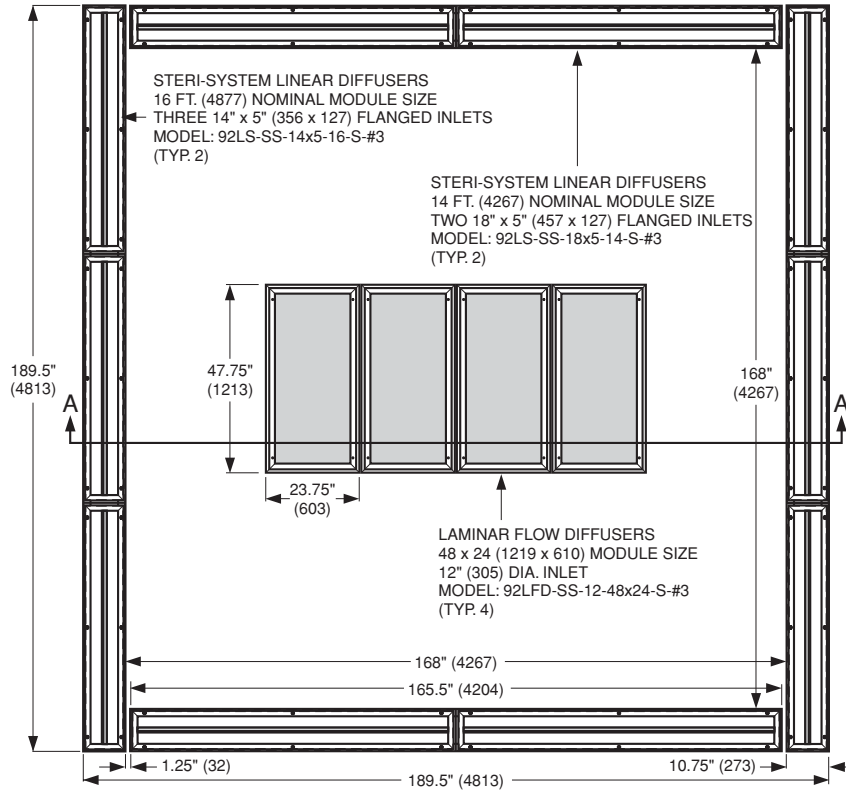
HOSPITAL / CLEANROOM DIFFUSERS

Dimensional Data • Steri-System 14 x 14 Module • Model: 92STSYS – 14 x 14

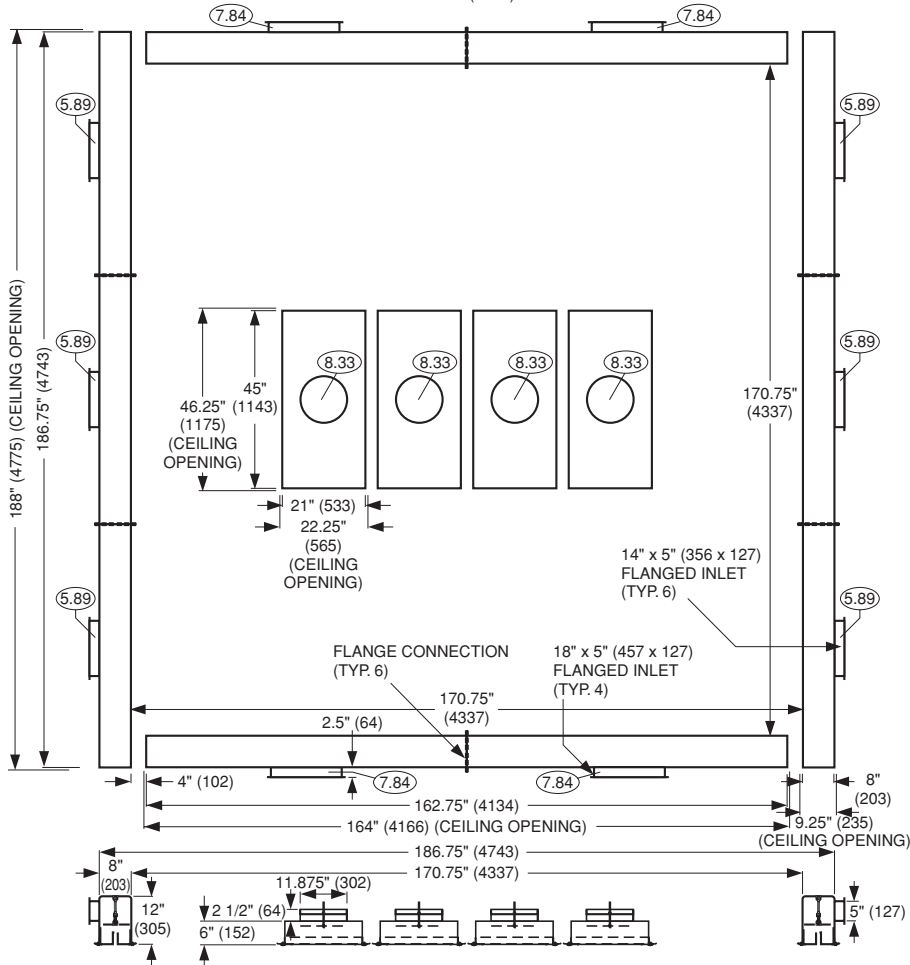


HOSPITAL / CLEANROOM DIFFUSERS

Reflected Ceiling View



Plenum Top View



RECOMMENDED PERCENTAGE OF TOTAL SYSTEM AIRFLOW SUPPLIED THROUGH IDENTIFIED INLET.

=

Section Detail A – A

HOW TO SPECIFY OR TO ORDER

(Show complete Model Number and Size, unless "Default" is desired).

Stainless Steel Steri-System Hospital Operating Room Air Systems – Model Series 92STSYS

		92STSYS - 12 x 10 - S - #3 - —			
MODEL				OPTIONS	
- 304 Stainless Steel	92STSYS			- None (default)	—
- 304 Stainless Steel with Perimeter Inlet Balancing Dampers	92STSYS-O			- 316 Stainless Steel Construction	316
NOMINAL MODULE SIZE (ft.) (mm)				FINISH	
- 8 x 4 (2438 x 1219)				- #3 Satin Polished (default)	#3
- 8 x 6 (2438 x 1829)				- Special Custom Color	SP
- 8 x 8 (2438 x 2438)				FRAME TYPE	
- 10 x 6 (3048 x 1829)				- Lay-in T-Bar	L
- 10 x 8 (3048 x 2438)				- Surface Mount	S
- 10 x 10 (3048 x 3048)					
- 12 x 6 (3658 x 1829)					
- 12 x 8 (3658 x 2438)					
- 12 x 10 (3658 x 3048)					
- 12 x 12 (3658 x 3658)					
- 14 x 8 (4267 x 2438)					
- 14 x 10 (4267 x 3048)					
- 14 x 12 (4267 x 3658)					
- 14 x 14 (4267 x 4267)					

SUGGESTED SPECIFICATION:

Furnish and install **Nailor Steri-System Model 92STSYS Hospital Operating Room Air Systems** of the size and type shown on the plans and air distribution schedules. The system shall be specially designed to reduce airborne contaminants, and thus, the risk of patient infection during surgery. The system shall be composed of two main components, Model 92LFD-SS Laminar Flow Diffusers and Model 92LS-SS Linear Slot Diffusers, constructed as follows:

The Laminar Flow Diffusers shall be constructed entirely from 304 stainless steel (316 optional), minimum 24 gauge. The perforated face of the diffuser shall have 13% free area with 3/32" (2.4) dia. holes on 1/4" (6) staggered centers. The face shall incorporate a second pressure plate as an integral assembly to ensure true laminar airflow. The face shall be attached with 1/4 turn fasteners to allow for complete removal and access to the interior for cleaning. All diffusers are to include safety cables to prevent accidental dropping of the removable face. A disc type damper, adjustable from the face of the diffuser, shall be provided with all units. Integral earthquake hanger tabs shall be included with all units.

The Linear Slot Diffusers shall be constructed entirely from 304 stainless steel (316 optional), minimum 24 gauge. The diffuser shall incorporate a non-adjustable single slot designed to create a vertical air curtain angled outwards 5 – 15°. The diffuser shall incorporate a pressure plate behind the slot to ensure uniform slot velocity. The pressure plate shall be 13% free area with 3/32" (2.4) dia. holes on 1/4" (6) staggered centers. The slot and pressure plate shall be attached with 1/4 turn fasteners to allow for complete removal and access to the interior for cleaning. The plenum shall incorporate radiused corners lengthwise to facilitate cleaning. Flanged plenum inlets are to be maximum 5" (127) in height to allow duct clearance over standard light fixtures. Plenums over 7 ft. (2134) in length shall be supplied in multiple sections with flange connections and stainless steel fasteners for field assembly. All diffusers are to include safety cables to prevent accidental dropping of the removable face. Integral earthquake hanger tabs shall be included with all units. All exposed surfaces shall have a #3 satin polished finish (optional finishes are available).

(Optional) An opposed blade damper, adjustable from the face of the diffuser, shall be provided on all perimeter inlets. Dampers shall be held in place with wing nut fasteners and be removable from the face of the diffuser.

The manufacturer shall provide published performance data for the system, which shall be tested in accordance with ANSI/ASHRAE Standard 70 – 1991.

SELECTION OF STERI-SYSTEM MODULE SIZE

The first step in determining module size is to determine the total supply airflow for the operating room. The following table summarizes the current guidelines for the various organizations shown.

The most stringent minimum number of air changes is published by ASHRAE and they are generally considered to be the code authority throughout the country. Some areas require a 100% outside air supply system which not only helps to reduce contaminants but can provide additional protection during a fire emergency. Operating rooms are obviously not easy to evacuate during a fire and the combination of a positive pressure and outside air can enhance smoke protection.

Based on these (or other) guidelines, determine the total number of air changes required for the operating room. With this and the room volume we can determine the total airflow to be supplied:

$$\text{Total Room Supply Airflow (cfm)} = \frac{\text{Total Room Volume (ft}^3\text{)} \times \text{\# of Room ACH}}{60}$$

We must then confirm that this airflow will fulfill the other requirements of the room such as cooling load and humidity requirements as well as maintaining the pressure relationships with the adjoining areas. Some systems must be capable of quickly reducing or increasing the room temperature and humidity during or between procedures and/or maintaining a lowered

design set point temperature of 60 – 65°F (15 – 18°C) during procedures. Also, best air distribution and comfort conditions are generally obtained when the supply air temperature differential during surgery is small and relatively constant. When the total room airflow is determined we can choose our Steri-System module size. From the chart on page E83 the total system airflow ranges and noise levels are shown. The system should be selected within the ranges shown on the chart with consideration as to final module size and its ability to accommodate the personnel and equipment as necessary. The standard systems shown have been designed to simplify the selection and layout process while providing maximum protection to the patient within the airflow ranges shown. The interior and perimeter pressure and flow relationships are maintained with 1/3 of the airflow being supplied through the laminar flow center panels and the remaining 2/3 through the perimeter curtain diffusers. Inlet sizes and air volumes per inlet have been designed to minimize sound and pressure drop and enhance system efficiency. The standard modules shown are only a small fraction of the possible combinations available and are sized to meet the most common conditions. If your particular requirements cannot be met with the standard module sizes, other combinations of laminar flow diffusers and/or perimeter curtains are available. Please contact your local Nailor representative for assistance on your particular application.

E

HOSPITAL / CLEANROOM DIFFUSERS

Source	Room Types	Minimum Air Changes/Hour ACH	Minimum Outside Air ACH	Minimum Filtration Efficiency
ASHRAE 2003 Handbook HVAC Applications	Operating Room Cystoscopic Rooms Delivery Room	25	5	Merv 17 (99.97%) for Orthopedic, Bone Marrow and Organ Transplant. Merv 14 (90%) for General Procedure and Delivery Rooms.
American Institute of Architects 2001 Edition Guidelines for Design & Construction of Hospital & Health Care Facilities	Operating/Surgical Cystoscopic Rooms Delivery Room Trauma Room Procedure Room	15	3	90%
	Bronchoscopy, Triage, ER or Radiology Waiting Rooms	12	3	
	Endoscopy	6	2	
Canadian Standards Assoc. CSA Standard Z317.2-01 September, 2001	Operating Rooms Endoscopy, Bronchoscopy, Cystoscopy, PACU, Surgical Day Care, Caesarean Delivery	20	6	99.97%

This table summarizes some of the current recommendations for operating room ventilation rates. Consult the actual documents for specific requirements and exceptions.

Performance Data

Steri-System • Hospital Operating Room Air Distribution Systems System Selection Chart:

Imperial Units

Module Size	Perimeter Slot Length (ft)	Perimeter Inlet Size(s) (Qty @ W x H)	Perimeter CFM Range (25-35-45 cfm/ft)	Center Panels Recommended Size (Qty @ Inlet – Module)	Center Panels CFM Range (Low-Med-High)	Total System CFM Range (Low-Med-High)	Total System NC (Low-Med-High)
8 x 4	25.17	2 @ 16 x 5, 4 @ 10 x 5	630-880-1135	2 @ 10" dia – 36 x 24	315-440-565	945-1320-1700	25-29-34
8 x 6	28.5	8 @ 10 x 5	715-1000-1285	2 @ 12" dia – 48 x 24	355-500-640	1070-1500-1925	23-25-29
8 x 8	32.5	4 @ 12 x 5, 4 @ 10 x 5	815-1140-1465	3 @ 10" dia – 36 x 24	405-570-730	1220-1710-2195	25-29-33
10 x 6	32.5	4 @ 12 x 5, 4 @ 10 x 5	815-1140-1465	3 @ 10" dia – 36 x 24	405-570-730	1220-1710-2195	25-29-33
10 x 8	36.5	8 @ 12 x 5	915-1280-1645	3 @ 10" dia – 48 x 24	455-640-825	1370-1920-2470	25-28-32
10 x 10	40.5	4 @ 16 x 5, 4 @ 12 x 5	1015-1420-1825	3 @ 12" dia – 48 x 24	505-710-910	1520-2130-2735	24-26-29
12 x 6	36.5	4 @ 16 x 5, 4 @ 10 x 5	915-1280-1645	4 @ 10" dia – 36 x 24	455-640-825	1370-1920-2470	25-29-32
12 x 8	40.5	4 @ 16 x 5, 4 @ 12 x 5	1015-1420-1825	3 @ 12" dia – 48 x 24	505-710-910	1520-2130-2735	24-26-29
12 x 10	44.5	8 @ 16 x 5	1115-1560-2005	3 @ 12" dia – 48 x 24	555-780-1000	1670-2340-3005	24-27-32
12 x 12	48.5	4 @ 18 x 5, 4 @ 16 x 5	1215-1700-2185	4 @ 12" dia – 48 x 24	605-850-1090	1820-2550-3275	22-27-28
14 x 8	44.5	4 @ 18 x 5, 4 @ 12 x 5	1115-1560-2005	4 @ 10" dia – 36 x 24	555-780-1000	1670-2340-3005	26-30-34
14 x 10	48.5	4 @ 18 x 5, 4 @ 16 x 5	1215-1700-2185	4 @ 12" dia – 48 x 24	605-850-1090	1820-2550-3275	22-27-28
14 x 12	52.5	8 @ 18 x 5	1315-1840-2365	4 @ 12" dia – 48 x 24	655-920-1180	1970-2760-3545	26-26-30
14 x 14	55.83	6 @ 14 x 5, 4 @ 18 x 5	1395-1955-2510	4 @ 12" dia – 48 x 24	700-975-1255	2095-2930-3765	24-24-32

Metric Units

Module Size	Perimeter Slot Length (m)	Perimeter Inlet Size(s) (Qty @ W x H)	Perimeter l/s Range (38.7-54.2-69.7 l/s/m)	Center Panels Recommended Size (Qty @ Inlet – Module)	Center Panels l/s Range (Low-Med-High)	Total System l/s Range (Low-Med-High)	Total System NC (Low-Med-High)
8 x 4	7.672	2 @ 406 x 127, 4 @ 254 x 127	297-415-536	2 @ 254" dia – 914 x 610	149-208-267	446-623-802	25-29-34
8 x 6	8.687	8 @ 254 x 127	337-472-606	2 @ 305" dia – 1219 x 610	168-236-302	505-708-908	23-25-29
8 x 8	9.906	4 @ 305 x 127, 4 @ 254 x 127	385-538-691	3 @ 254" dia – 914 x 610	191-269-344	576-807-1036	25-29-33
10 x 6	9.906	4 @ 305 x 127, 4 @ 254 x 127	385-538-691	3 @ 254" dia – 914 x 610	191-269-344	576-807-1036	25-29-33
10 x 8	11.125	8 @ 305 x 127	432-604-776	3 @ 254" dia – 1219 x 610	215-302-389	647-906-1166	25-28-32
10 x 10	12.344	4 @ 406 x 127, 4 @ 305 x 127	479-670-861	3 @ 305" dia – 1219 x 610	238-335-429	717-1005-1291	24-26-29
12 x 6	11.125	4 @ 406 x 127, 4 @ 254 x 127	432-604-776	4 @ 254" dia – 914 x 610	215-302-389	647-906-1166	25-29-32
12 x 8	12.344	4 @ 406 x 127, 4 @ 305 x 127	479-670-861	3 @ 305" dia – 1219 x 610	238-335-429	717-1005-1291	24-26-29
12 x 10	13.564	8 @ 406 x 127	526-736-946	3 @ 305" dia – 1219 x 610	262-368-472	788-1104-1418	24-27-32
12 x 12	14.783	4 @ 457 x 127, 4 @ 406 x 127	573-802-1031	4 @ 305" dia – 1219 x 610	285-401-514	859-1203-1545	22-27-28
14 x 8	13.564	4 @ 457 x 127, 4 @ 305 x 127	526-736-946	4 @ 254" dia – 914 x 610	262-368-472	788-1104-1418	26-30-34
14 x 10	14.783	4 @ 457 x 127, 4 @ 406 x 127	573-802-1031	4 @ 305" dia – 1219 x 610	285-401-514	859-1203-1545	22-27-28
14 x 12	16.002	8 @ 457 x 127	621-868-1116	4 @ 305" dia – 1219 x 610	309-434-557	930-1302-1673	26-26-30
14 x 14	17.017	6 @ 356 x 127, 4 @ 457 x 127	658-923-1184	4 @ 305" dia – 1219 x 610	330-460-592	989-1383-1777	24-24-32

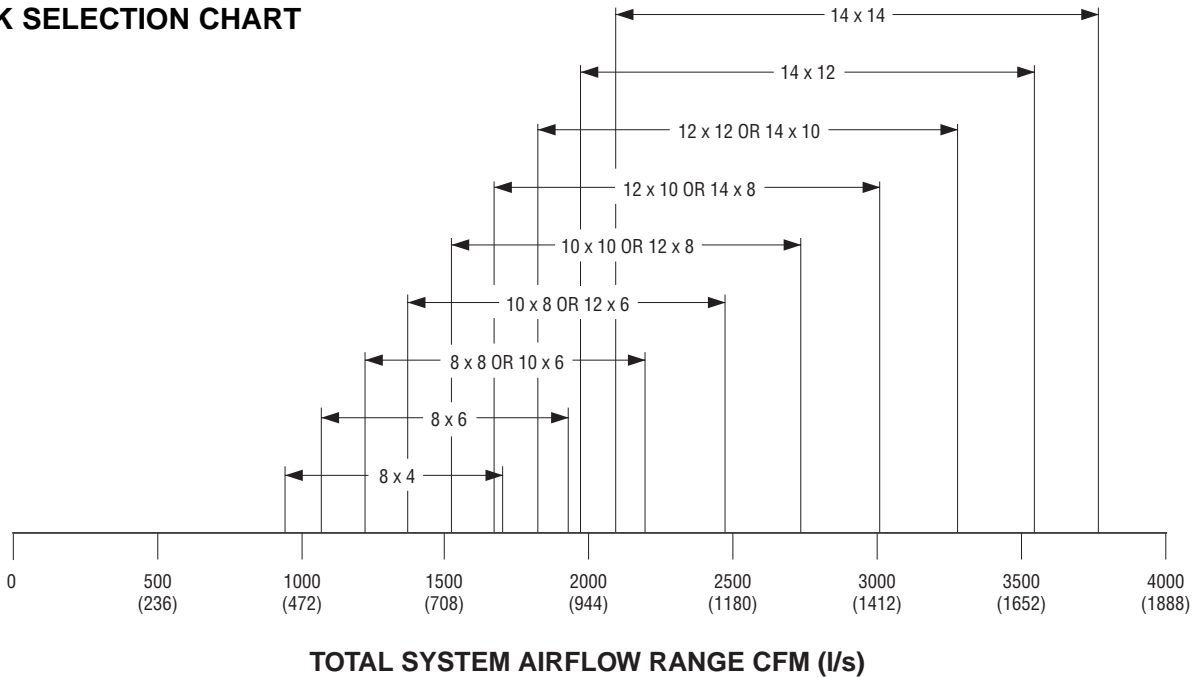
Performance Notes:

- Data derived from tests conducted in accordance with ANSI/ASHRAE Standard 70 – 1991.
- Noise Criteria (NC) values based on 10 dB room absorption re 10⁻¹² watts with dampers fully open.
- Airflows to be selected based on 1/3 of total airflow through the center panels and the remaining 2/3 through the perimeter. Refer to Steri-System plenum drawings for the recommended percentage of total airflow per individual inlet.
- To accommodate various ceiling configurations such as lights and equipment, center panels and layouts can be varied slightly. It is important to maintain panel areas and overall configuration for proper performance. Contact your local Nailor representative for assistance on your particular application.

Performance Data

Steri-System • Hospital Operating Room Air Distribution Systems

QUICK SELECTION CHART



TOTAL SYSTEM AIRFLOW RANGE CFM (l/s)

SELECTION EXAMPLE

Design Criteria: General Procedure Operating Room
 Room Size: 20 ft wide x 25 ft long x 10 ft ceiling height
 = 5000 ft³ Room Volume
 Minimum: 8 ft x 8 ft Clean Zone Required
 Supply Air Temperature: 55°F
 Room Temperature Set Point Range: 62 – 80°F
 Airflow: Minimum 25 ACH (recirculating system) –
 Positive room pressure
 Sound Level: 25 – 35 NC

Calculate required room airflow rate:

$$\text{Airflow (cfm)} = \frac{\text{Room Volume (ft}^3\text{)} \times \text{ACH}}{60}$$

$$\text{Airflow (cfm)} = 5000 \times 25 / 60 = 2083 \text{ cfm}$$

We must then confirm that this airflow will meet the maximum cooling load requirement for the room (not shown). Note that the room temperature must be able to be maintained at the lowest specified temperature for some procedures (62°F in this example). With a 55°F supply air temperature the load may, in some cases, require an increase in airflow to compensate for the low ΔT between supply air and room temperature. Also some procedures may require the system to quickly reduce or increase the room temperature and humidity during or between procedures. One of the features of the Steri-System design concept is the creation of a micro-climate within the clean zone. The enhanced air change rate within the curtain (Refer to Table 1 in the Engineering Section) and the use of non-aspirating Laminar Flow Diffusers create a room within a room effect. An analysis of the cooling load within the air curtain should be considered for critical

projects. Obviously, for the 80°F set point, the reheat coil and modulating valve must be sized accordingly. (Refer to the Nailor VAV Terminal Units catalog for more information on reheat coil selection).

From the selection chart we see that the airflow falls midrange for a 12 x 8 Steri-System module size which meets our minimum specified clean zone size. From the module layout page we have all the pertinent dimensions as well as recommended inlet sizes and airflows. This should be co-ordinated with the desired ceiling layout for surgical lighting, utility columns, monitors and equipment etc.. Several different module sizes will meet the specified criteria and the choice will generally depend on the layout. (Placement of diffusers above the table should take priority over placement of light fixtures).

Also from the selection chart, we find a system NC level of 26 which falls well within the recommended sound levels. Therefore a standard 12 x 8 Module Steri-System will meet our criteria for this example.

For return air grille sizing and room pressurization we will use the recommended 85% of the supply air total and a minimum of two inlets.

Therefore:

$$\text{Total Return Air} = \text{Supply Airflow} \times 0.85 = 2083 \times 0.85 = 1770 \text{ cfm total}$$

or for two inlets

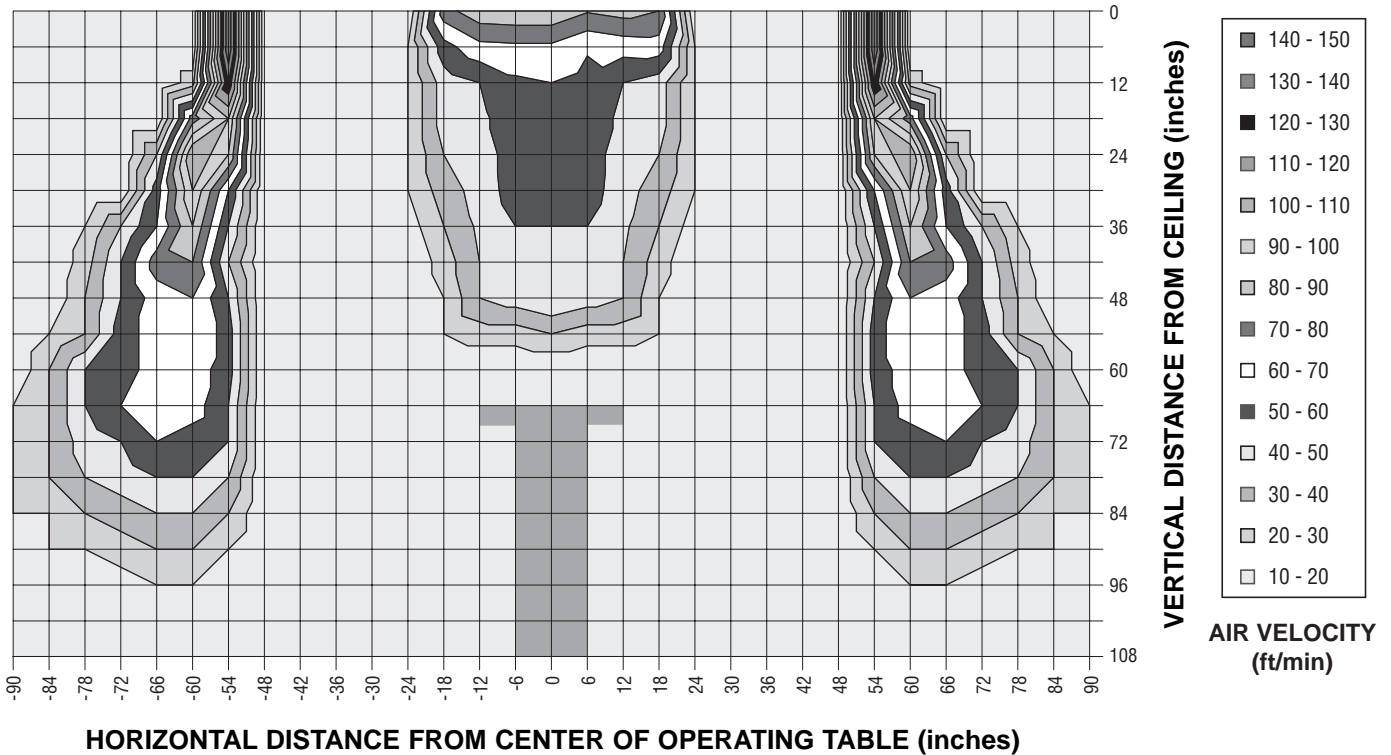
$$= 885 \text{ cfm each}$$

For a standard Model 67FB45 and sizing for low sound and pressure drop we find that two grilles 18" x 18" (or equivalent size) will be sufficient, resulting in a low noise level (< NC 20) and pressure drop (< 0.1" w.g.).

Performance Data

Steri-System • Hospital Operating Room Air Distribution Systems

PERFORMANCE TEST – 12 x 8 STERI-SYSTEM MODULE (Medium Airflow Range – 35 cfm/ft Perimeter / 30 cfm/sq. ft Center Panels)



NOTE:

The graph above shows actual air velocities and the associated isovels. This data was obtained in a full scale mock-up test performed on a standard 12 x 8 Steri-System module under isothermal conditions.

Performance Notes:

1. Data derived from tests conducted in accordance with ANSI/ASHRAE Standard 70 – 1991.
2. Performance is for standard 12 x 8 module Steri-System under isothermal conditions.
3. Perimeter Airflow = 1420 cfm (670 l/s).
Laminar Airflow = 710 cfm (335 l/s).
Total Airflow = 2130 cfm (1005 l/s).



Photo shows standard 12 x 8 Steri-System module installed in the Nailor Air Distribution laboratory.



HOSPITAL / CLEANROOM DIFFUSERS