

Healthcare, Laboratories, and Cleanrooms



AIR DISTRIBUTION PRODUCTS FOR HEALTHCARE, LABORATORIES, AND CLEANROOMS

Greenheck offers a complete line of products designed for cleanrooms, hospital operating rooms, patient isolation rooms as well as laboratories and manufacturing facilities.



Laminar Flow Diffusers have been engineered to provide a vertical projection of low velocity supply air. The laminar flow diffuser introduces clean supply air without the entrainment of airborne particulate maintaining an aseptic environment below the diffusers.

PAGE 3



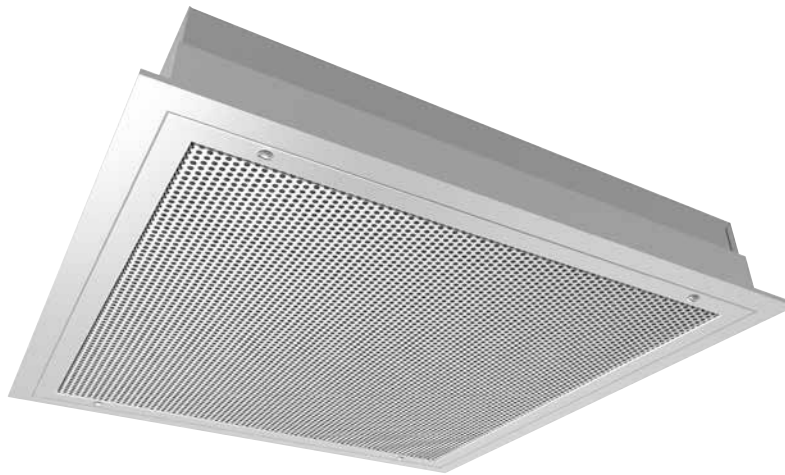
Radial Flow Diffusers are an effective method of air distribution for laboratory and patient isolation room applications where a high volume of air is required. The air pattern design produces a uniform pattern to prevent dead spots where contaminants can remain.

PAGE 22



Surgical Air Curtain systems are custom designed and precisely fabricated to accommodate the specialized medical, mechanical, and electrical considerations of today's operating room environments.

PAGE 34



LAMINAR FLOW DIFFUSERS

Model HLC-LFD laminar flow diffuser is engineered for supply air distribution in critical environments such as hospital operating rooms and cleanrooms. The diffusers are engineered to supply a low velocity vertical “piston” of conditioned air.

PAGE 4

Model HLC-GSL is an excellent choice for critical care environments when the application calls for the use of a HEPA filter in the supply diffuser. The GS series has an airtight filter housing to accommodate a gel seal HEPA filter and provides exceptional performance.

PAGE 10

Model HLC-CLF laminar flow diffusers are engineered for supply air distribution in critical environments such as hospital operating rooms and cleanrooms. The diffusers are engineered to supply a low velocity vertical “piston” of conditioned air. The HLC-CLF utilizes an inner baffle system which ensures a consistent laminar face velocity further minimizing entrainment beyond the standard laminar flow diffusers.

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SERIES HLC-LFD

Aluminum Construction

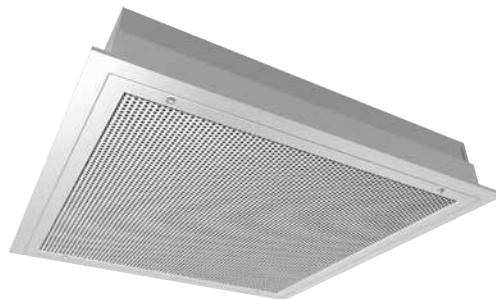
HLC-LFD-AL-1 – Surface Mount

HLC-LFD-AL-6 – Standard T-bar Lay-in

Stainless Steel Construction

HLC-LFD-SS-1 – Surface Mount

HLC-LFD-SS-6 – Standard T-bar Lay-in



Air outlets shall be model HLC-LFD-AL (aluminum) or HLC-LFD-SS

manufactured by GREENHECK. Diffuser shall include an upper and lower pressure chamber and shall generate a low velocity, vertical piston of discharge air. Diffuser shall be Group E Non-Aspirating Diffuser per ASHRAE Standard 170.

Diffuser shall be constructed of a one-piece perforated face and core assembly that is removable from the backpan with quarter turn fasteners accessible from the face. Face and core assemblies mounted with internal spring clips or other mechanical fastening devices are not acceptable. Units shall include stainless steel safety chains attaching the face assembly to the backpan.

Core and face assembly shall be removable to allow sanitizing in an autoclave and allow access to the backpan for cleaning. With the core assembly removed, the inside of the backpan must be completely accessible for cleaning. Units with permanently fixed dampers, baffles or deflectors mounted in the backpan are not acceptable. Face shall be flush with the ceiling surface.

Perforated face shall have a

- 51% free area with 3/16" holes on 1/4" staggered centers.
- 23% free area with 1/16" holes on 1/8" staggered centers.
- 16% free area with 5/64" holes on 3/16" staggered centers.

Units shall have round inlets. Units shall be designed to integrate into the specified ceiling system. The units shall be the size and quantity as outlined in the plans and specifications.

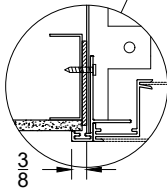
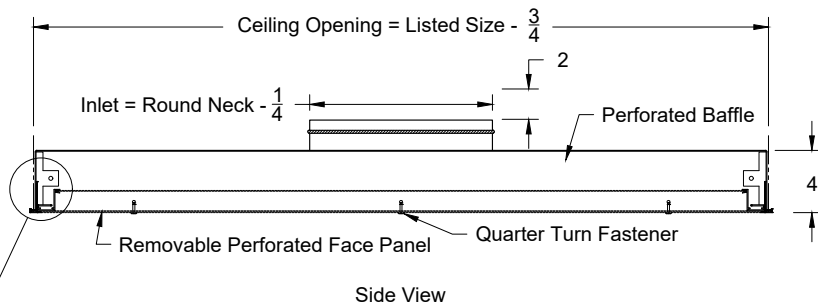
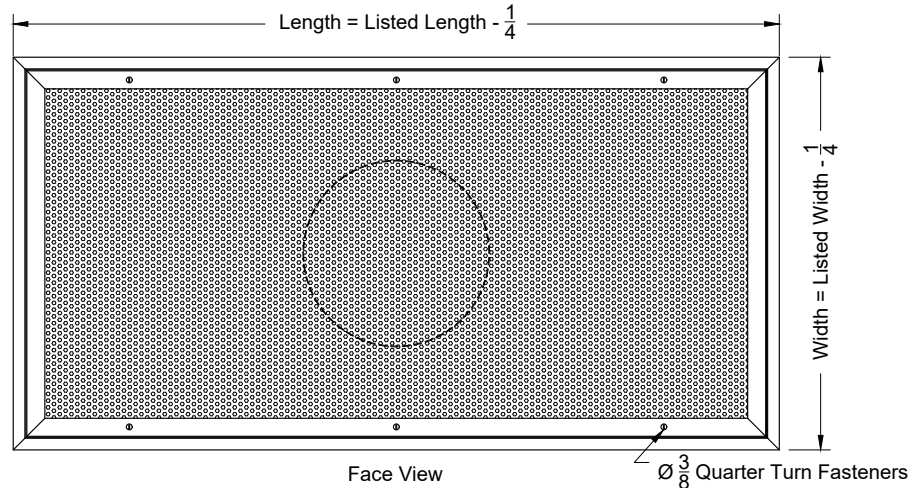
Performance Specification

The manufacturer shall provide published performance data. Data shall be tested in accordance to ANSI/ASHRAE Standard 70 and 113.

MODEL HLC-LFD-AL

Model: HLC-LFD-AL-1 Aluminum Face and Backpan - Flush Surface Mount

HLC-LFD-AL-1 - Flush Surface Mount



Available Sizes						
Widths	12	24	36	-	-	-
Lengths	-	24	36	48	60	72

Available Round Neck Sizes					
Neck	6	8	10	12	14

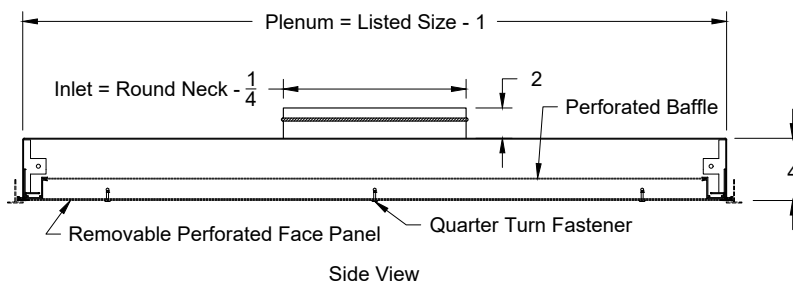
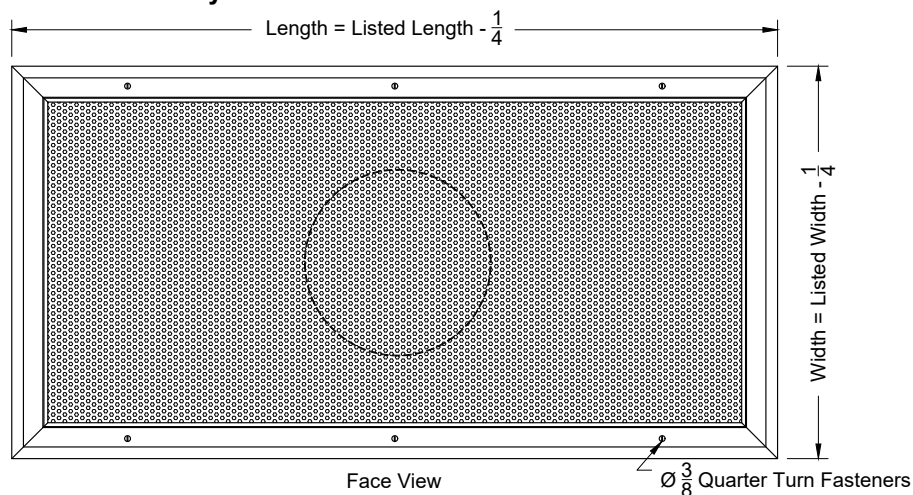
1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
Standard Finish: 01 White Finish 24 Mill Finish	XG-TBPF - T-Bar Plaster Frame XG-D3 - Radial Opposed Blade Damper	EI - External 1/2" Insulation	<ul style="list-style-type: none"> Spot Welded and Sealed Construction Classified as ASHRAE Group E Non-Aspirating Diffuser, Compliant with ASHRAE 170 Requirements Perforated Panel Free Areas: 16%, 23% and 51% Available Aluminum face and backpan

All Dimensions $\pm 1/16"$

MODEL HLC-LFD-AL

Model: HLC-LFD-AL-6 Aluminum Face and Backpan - T-Bar Lay In

HLC-LFD-AL-6 - T-Bar Lay In



Available Sizes						
Widths	12	24	36	-	-	-
Lengths	-	24	36	48	60	72

Available Round Neck Sizes					
Neck	6	8	10	12	14

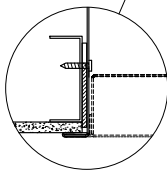
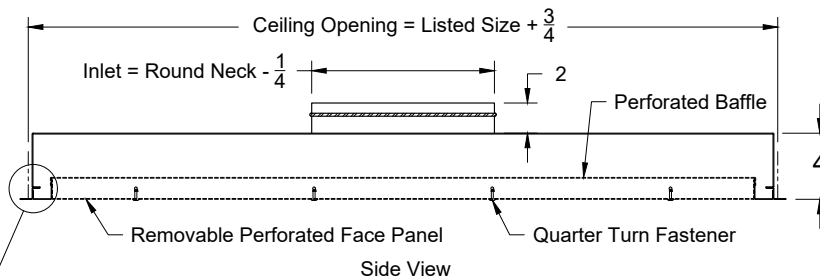
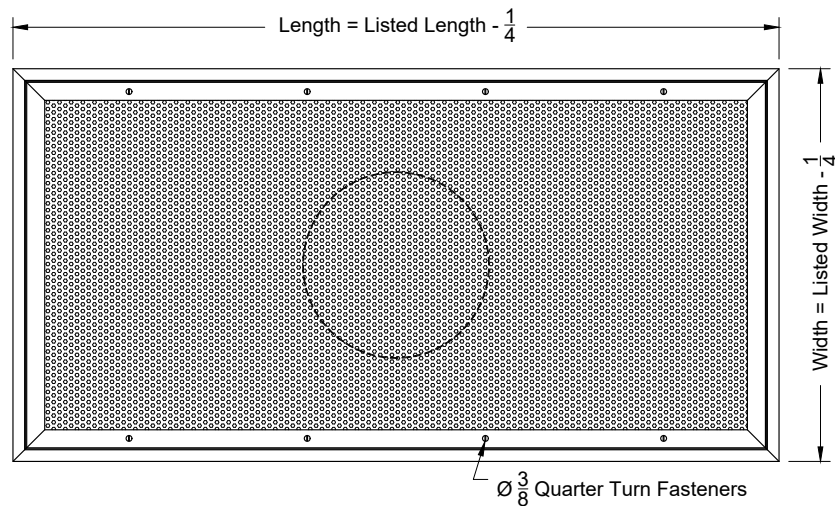
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All Dimensions $\pm 1/16$ "

MODEL HLC-LFD-SS

Model: HLC-LFD-SS-1 Stainless Steel Face and Backpan - Flush Surface Mount

HLC-LFD-SS-1 - Flush Surface Mount



Flush Surface Mount Detail:
C-Channel, Wood Blocks,
Shims & Fastening Provided
By Others. Use Shims To
Center Diffuser In Opening.

Available Sizes						
Widths	12	24	36	-	-	-
Lengths	-	24	36	48	60	72

Available Round Neck Sizes					
Neck	6	8	10	12	14

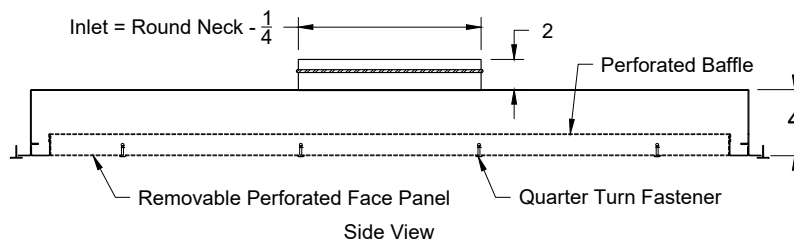
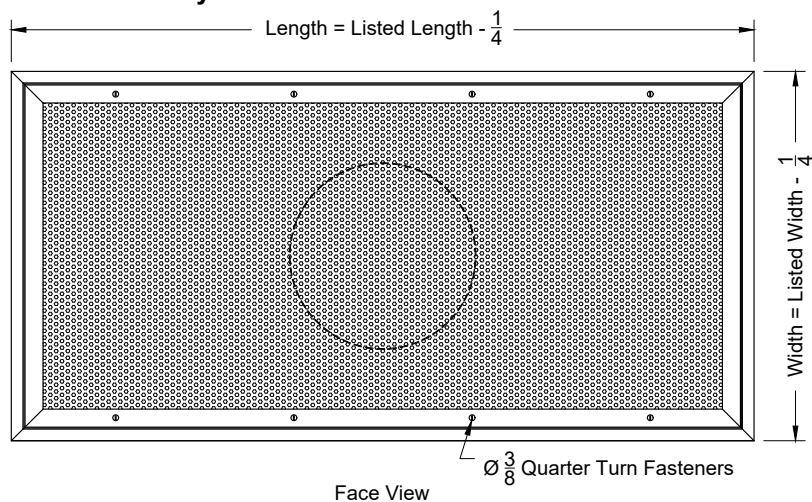
1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
Standard Finish: 24 Mill Finish Optional Finish: 01SS White	XG-BDS-SS - Stainless Butterfly Damper XG-TBPFSS - Stainless Steel TBPF	EI - External 1/2" Insulation	<ul style="list-style-type: none"> Fully welded Seams and Frame Standard with Equalization Baffle Classified as ASHRAE Group E Non-Aspirating Diffuser, Compliant with ASHRAE 170 Requirements Perforated Panel Free Areas: 16%, 23% and 51% Available Stainless Steel Construction

All Dimensions $\pm 1/16$ "

MODEL HLC-LFD-SS

Model: HLC-LFD-SS-6 Stainless Steel Face and Backpan - T-Bar Lay In

HLC-LFD-SS-6 - T-Bar Lay In



Available Sizes						
Widths	12	24	36	-	-	-
Lengths	-	24	36	48	60	72

Available Round Neck Sizes					
Neck	6	8	10	12	14

1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
Standard Finish: 24 Mill Finish Optional Finish: 01SS White	XG-BDS-SS - Stainless Butterfly Damper XG-TBPFSS - Stainless Steel TBPF	EI - External 1/2" Insulation	<ul style="list-style-type: none"> Fully welded Seams and Frame Standard with Equalization Baffle Classified as ASHRAE Group E Non-Aspirating Diffuser, Compliant with ASHRAE 170 Requirements Perforated Panel Free Areas: 16%, 23% and 51% Available Stainless Steel Construction

All Dimensions $\pm 1/16"$

SERIES HLC-LFD PERFORMANCE DATA

HLC-LFD

CFM Per Square Foot	16% Free Area		23% Free Area		51% Free Area	
	Ps	NC	Ps	NC	Ps	NC
20	.012	<15	.010	<15	.004	<15
30	.024	<15	.021	<15	.010	<15
40	.043	19	.038	18	.017	<15
50	.067	22	.060	21	.027	18
60	.094	31	.086	29	.038	22
70	.129	37	.117	35	.052	24
80	.168	40	.152	38	.068	30
90	.213	42	.193	40	.086	35
100	-	-	-	-	.107	39

PERFORMANCE NOTES FOR SERIES HLC-LFD

All data is tested in accordance with ANSI/ASHRAE 70 and 113.

DEFINITION OF UNITS

Ps Static pressure loss through the diffuser and does not include velocity pressure

NC Based on L_w re: 10^{-12} watt, includes 10 dB room attenuation and a maximum inlet velocity of 500 fpm

CFM Cubic Feet per Minute (air)

fpm Velocity of airstream in Feet per Minute

SERIES HLC-GSL

HLC-GSL Laminar Flow Diffuser is engineered to supply air in critical environments such as cleanrooms, laboratories, hospital operating rooms, and patient isolation rooms. The diffuser provides a means of controlling particle contamination within the room by providing a unidirectional vertical “piston” of conditioned air. This vertical “piston” is non-aspirating with only minimal entrainment complying with ASHRAE 170 requirements. The HLC-GSL utilizes a 2" thick, pleated filter element, which enables the overall diffuser housing to be a maximum of 9" high.

- Tested in accordance with IEST-RP-CC-034. The standard gel seal HEPA filter is scan tested to meet an efficiency rating of 99.99%
- Knife Edge Flange penetrates the HEPA filter (silicone) gel seal to provide a leakproof seal between the filter and the housing
- Airtight Filter Housing construction at all joints and corners
- Flush Appearance with quarter turn fasteners to allow easy removal of perforated face
- Available in aluminum or stainless steel construction

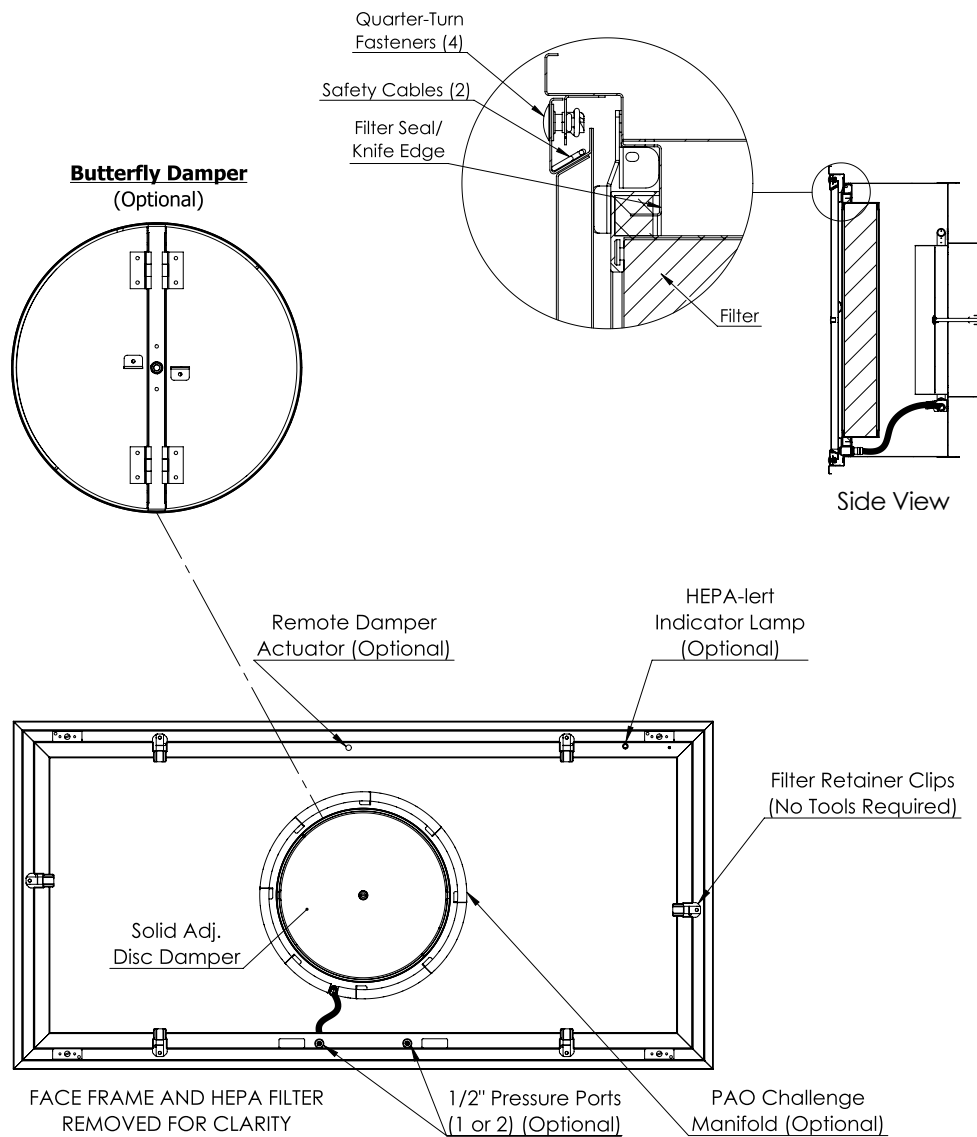


MODEL HLC-GSL

Model: HLC-GSL-SS Laminar Flow HEPA Diffuser – Stainless Steel Face and Backpan HLC-GSL-AL Laminar Flow HEPA Diffuser – Aluminum Face and Stainless Steel Backpan																																				
		<table><tr><th colspan="7">Available Sizes</th></tr><tr><td>Widths</td><td>12</td><td>24</td><td>36</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Lengths</td><td>-</td><td>24</td><td>36</td><td>48</td><td>60</td><td>72</td></tr></table> <table><tr><th colspan="6">Available Round Neck Sizes</th></tr><tr><td>Neck</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td></tr></table>		Available Sizes							Widths	12	24	36	-	-	-	Lengths	-	24	36	48	60	72	Available Round Neck Sizes						Neck	6	8	10	12	14
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All Dimensions ±1/16"																																				

MODEL HLC-GSL

Model: HLC-GSL Laminar Flow HEPA Diffuser Details



SERIES HLC-GSL HOSPITAL DIFFUSER PERFORMANCE DATA

LAMINAR FLOW DIFFUSER WITH GEL SEAL HEPA FILTER

8" Diameter Inlet												
Nominal Size	Airflow, CFM	100	120	140	160	180	200	220	240	260	280	295
24" x 24" Module	Pt	0.17	0.24	0.32	0.42	0.54	0.66	0.8	0.95	1.12	1.3	1.44
	Ps	0.16	0.23	0.31	0.41	0.52	0.64	0.77	0.92	1.08	1.25	1.39
	NC	-	17	19	22	25	27	29	31	34	35	37
	Throw (feet)	0-1-2	0-1-3	1-2-4	1-2-4	2-3-5	2-4-6	3-4-6	3-5-7	3-5-8	4-6-8	5-6-9
36" x 24" Module	Pt	0.07	0.1	0.14	0.18	0.23	0.29	0.35	0.41	0.48	0.56	0.62
	Ps	0.07	0.1	0.13	0.17	0.21	0.26	0.32	0.38	0.45	0.52	0.58
	NC	-	15	18	21	24	26	28	30	33	34	36
	Throw (feet)	0-1-2	0-1-2	0-1-3	1-2-4	1-2-5	2-3-5	2-3-6	2-4-6	3-5-7	3-5-8	3-5-8
48" x 24" Module	Pt	0.05	0.07	0.09	0.12	0.15	0.18	0.22	0.27	0.31	0.36	0.4
	Ps	0.04	0.06	0.08	0.1	0.13	0.16	0.2	0.24	0.28	0.32	0.36
	NC	-	-	17	20	23	25	27	30	32	33	35
	Throw (feet)	0-1-2	1-1-2	1-1-3	1-2-3	1-2-4	1-2-5	2-3-5	2-3-6	2-4-7	2-5-7	3-5-7

10" Diameter Inlet												
Nominal Size	Airflow, CFM	160	180	200	220	240	260	280	300	320	340	360
36" x 24" Module	Pt	0.14	0.18	0.22	0.27	0.32	0.37	0.43	0.5	0.56	0.64	0.71
	Ps	0.14	0.17	0.21	0.26	0.3	0.36	0.41	0.48	0.54	0.61	0.69
	NC	15	18	20	21	23	26	28	30	32	34	36
	Throw (feet)	1-2-4	1-2-5	2-3-5	2-3-6	2-4-6	3-4-7	3-5-8	3-5-8	4-6-9	4-6-9	5-7-10
48" x 24" Module	Pt	0.08	0.1	0.13	0.15	0.18	0.21	0.25	0.28	0.32	0.37	0.41
	Ps	0.08	0.1	0.12	0.14	0.17	0.2	0.23	0.27	0.3	0.34	0.38
	NC	-	15	18	19	22	25	27	29	31	33	35
	Throw (feet)	1-1-3	1-2-4	1-2-5	2-3-5	2-3-6	2-4-7	2-5-7	3-5-7	3-5-8	4-6-9	5-7-9

12" Diameter Inlet												
Nominal Size	Airflow, CFM	230	260	290	315	345	375	400	430	460	490	520
48" x 24" Module	Pt	0.16	0.2	0.25	0.29	0.35	0.42	0.48	0.55	0.63	0.71	0.8
	Ps	0.15	0.19	0.24	0.28	0.34	0.4	0.46	0.53	0.61	0.69	0.78
	NC	15	18	21	22	25	28	30	32	35	38	42
	Throw (feet)	1-2-6	2-3-7	2-4-7	3-5-8	4-6-8	5-6-9	5-7-9	6-8-10	6-8-11	7-9-12	7-9-12

PERFORMANCE NOTES FOR SERIES HLC-GSL

All data is tested in accordance with ANSI/ASHRAE 70 and 113.

DEFINITION OF UNITS

Ps Static pressure loss through the diffuser and does not include velocity pressure. Measured in inches wg.

Pt Total pressure = Static Pressure + Velocity Pressure

NC Based on Lw re: 10⁻¹² watt, includes 10 dB room attenuation and a maximum inlet velocity of 500 fpm

CFM Cubic Feet per Minute (air)

Throw Non-isothermal horizontal throw (supply air temperature 10°F colder than average room temperature); values are for 100, 75, and 50 fpm velocities

HEPA Filter HEPA filter is high efficiency filter with 99.97% efficiency on particles with diameters of 0.3 microns

SERIES HLC-CLF

Aluminum Construction

HLC-CLF-AL-1 – Surface Mount

HLC-CLF-AL-6 – Standard T-bar Lay-in

Stainless Steel Construction

HLC-CLF-SS-1 – Surface Mount

HLC-CLF-SS-6 – Standard T-bar Lay-in

Air outlets shall be model HLC-CLF-AL (aluminum) or HLC-CLF-SS (stainless steel) manufactured by GREENHECK. Diffuser shall have two chambers with an internal baffle system and shall generate a low velocity, vertical piston of discharge air.

Diffuser shall be constructed of a one-piece perforated face and core assembly that is removable from the welded backpan with quarter turn fasteners accessible from the face. Face and core assemblies mounted with internal spring clips or other mechanical fastening devices are not acceptable. Units shall include stainless steel safety chains attaching the face assembly to the backpan.

Core and face assembly shall be removable to allow sanitizing in an autoclave and allow access to the backpan for cleaning. With the core assembly removed, the inside of the backpan must be completely accessible for cleaning. Units with permanently fixed dampers, baffles or deflectors mounted in the backpan are not acceptable. Face shall be flush with the ceiling surface.

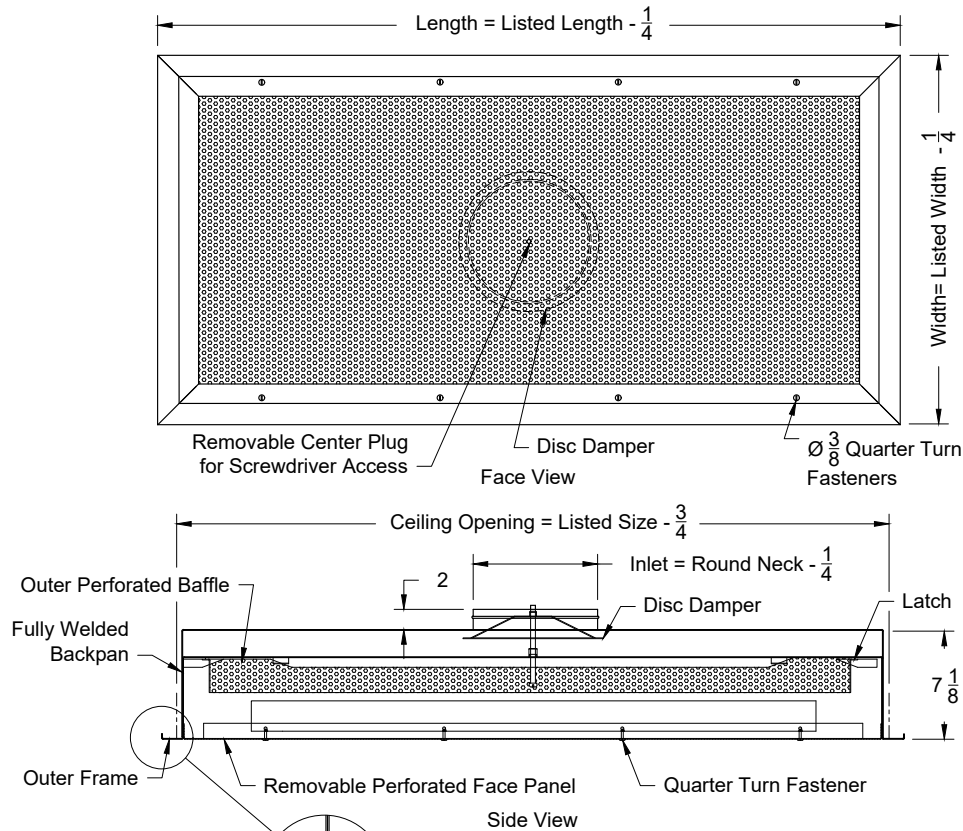
Perforated face shall have a 16%, 23%, or 51% free area.

Units shall have round inlets. Units shall be designed to integrate into the specified ceiling system. The units shall be the size and quantity as outlined in the plans and specifications. The manufacturer shall provide published performance data. Data shall be tested in accordance to ANSI/ASHRAE Standard 70 and 113.

MODEL HLC-CLF-AL

Model: HLC-CLF-AL-1 Multi-Chamber Laminar Flow - Fully Welded Backpan - Flush Surface Mount

HLC-CLF-AL-1 - Flush Surface Mount



Flush Surface Mount Detail:
C-Channel, Wood Blocks,
Shims & Fastening Provided
By Others. Use Shims to
Center Diffuser In Opening.

Available Sizes			
Widths	12	24	-
Lengths	24	36	48

Available Round Neck Sizes						
Neck	6	8	10	12	14	

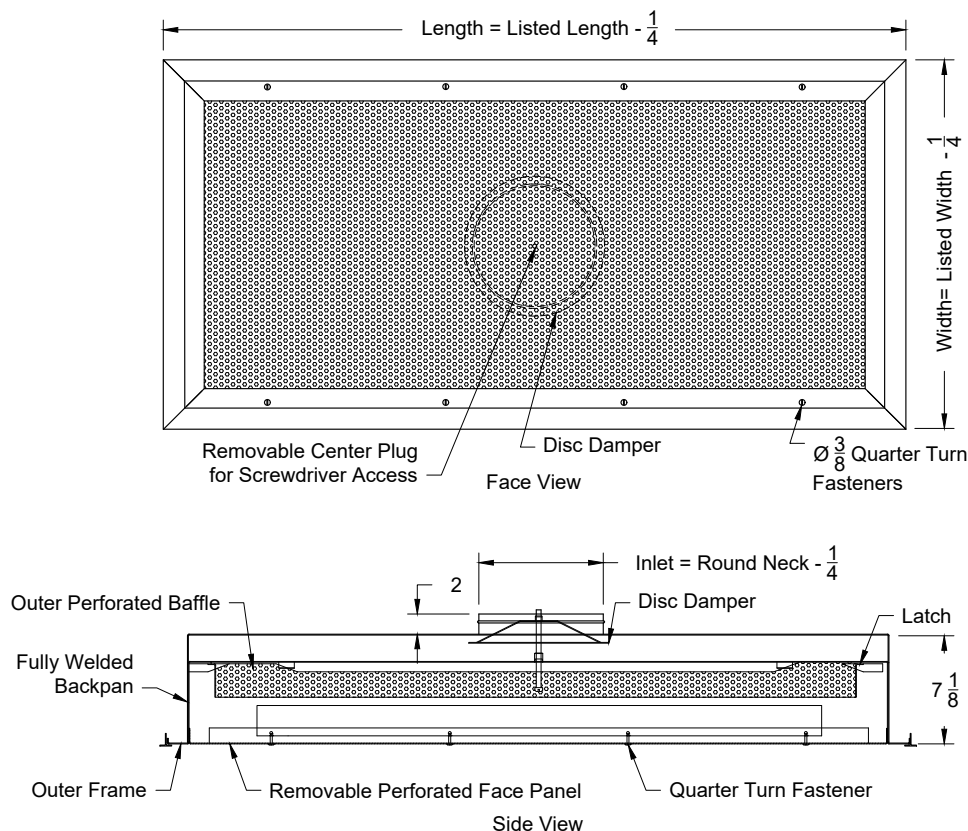
1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
Standard Finish: 01 White Finish 24 Mill Finish	XG-TBPF - T-Bar Plaster Frame	EI - External 1/2" Insulation DD - Disk Damper	<ul style="list-style-type: none"> Fully welded Seams and Frame Standard Multi-Chamber Design Classified as ASHRAE Group E Non-Aspirating Diffuser, Compliant with ASHRAE 170 Requirements Perforated Panel Free Areas: 16%, 23% and 51% Available Aluminum face and backpan

All Dimensions ±1/16"

MODEL HLC-CLF-AL

Model: HLC-CLF-AL-6 Multi-Chamber Laminar Flow Diffuser - Fully Welded Backpan - T-Bar Lay In

HLC-CLF-AL-6 - T-Bar Lay In



Available Sizes			
Widths	12	24	-
Lengths	24	36	48

Available Round Neck Sizes					
Neck	6	8	10	12	14

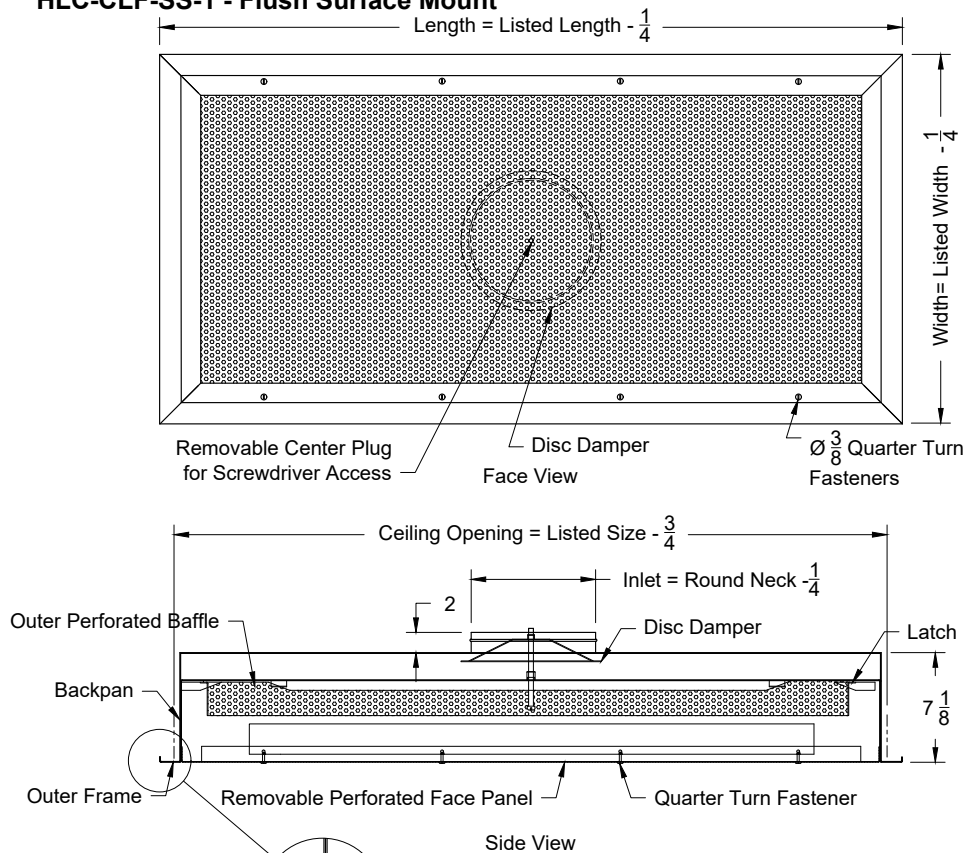
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All Dimensions $\pm 1/16$ "

MODEL HLC-CLF-SS

Model: HLC-CLF-SS-1 Multi-Chamber Laminar Flow - Fully Welded Backpan - Flush Surface Mount

HLC-CLF-SS-1 - Flush Surface Mount



Flush Surface Mount Detail:
C-Channel, Wood Blocks,
Shims & Fastening Provided
By Others. Use Shims to
Center Diffuser In Opening.

Available Sizes			
Widths	12	24	-
Lengths	24	36	48

Available Round Neck Sizes					
Neck	6	8	10	12	14

1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
Standard Finish: 24 Mill Finish Finish 01SS White	XG-TBPFSS - Stainless Steel TBPF XG-BDS-SS - Stainless Steel Butterfly Damper	EI - External 1/2" Insulation DD - Disk Damper	<ul style="list-style-type: none"> Fully welded Seams and Frame Standard Multi-Chamber Design Classified as ASHRAE Group E Non-Aspirating Diffuser, Compliant with ASHRAE 170 Requirements Perforated Panel Free Areas: 16%, 23% and 51% Available Stainless Steel Construction

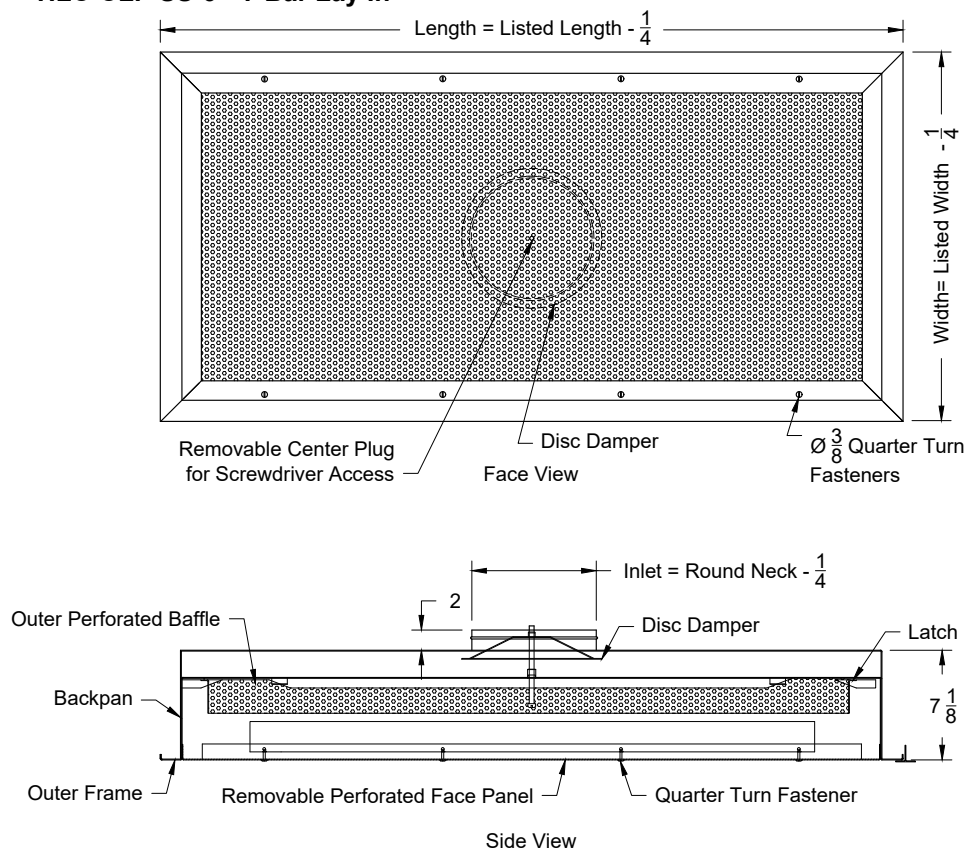
All Dimensions $\pm 1/16"$

MODEL HLC-CLF-SS

Model: HLC-CLF-SS-6

Multi-Chamber Laminar Flow - Fully Welded Backpan - T-Bar Lay In

HLC-CLF-SS-6 - T-Bar Lay In



Available Sizes			
Widths	12	24	-
Lengths	24	36	48

Available Round Neck Sizes						
Neck	6	8	10	12	14	

1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
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All Dimensions ±1/16"

HLC-CLF LAMINAR FLOW DIFFUSER PERFORMANCE DATA

(20-40 CFM/FT²) 16% FREE AREA

Table 1: Airflow Performance Data

AVERAGE VELOCITIES BELOW MODULES @ 10°F D.T.D. ¹						
FACE VELOCITY (CFM/FT ²) ²	DISTANCE BELOW FACE (FT)					
	1	2	3	4	5	6
20	53	55	53	53	49	42
25	62	64	69	67	58	48
30	71	72	72	71	61	50
35	78	78	79	78	71	60
40	87	89	88	86	80	73

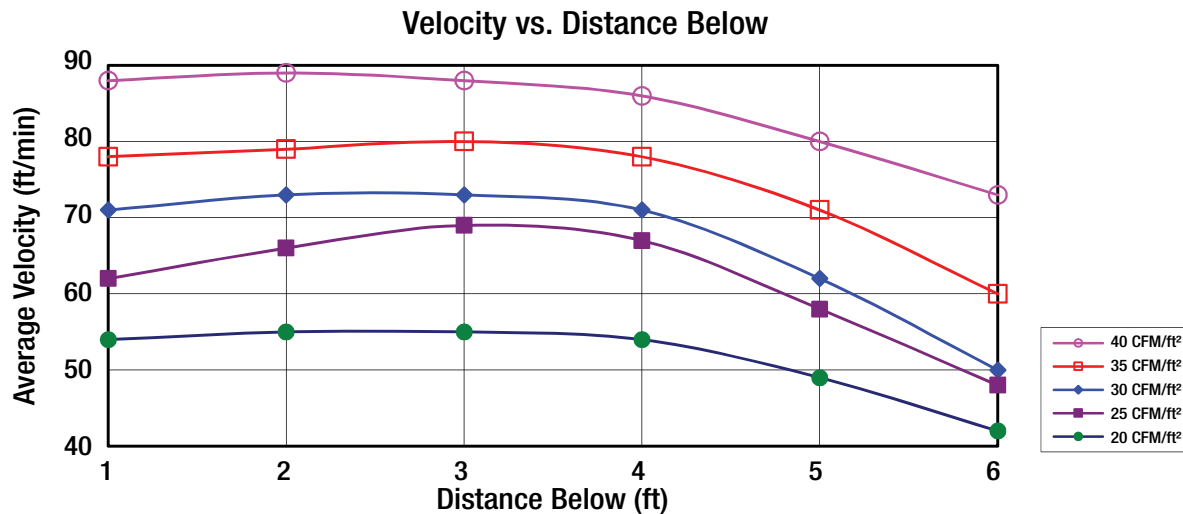


Table 2: Static Pressure & Noise Measurement

STATIC PRESSURE AND SOUND LEVEL		
CFM/FT ²	DUCT APPLICATION	
	STATIC PRESSURE ^{3,4}	N.C. LEVEL ^{4,5}
20	0.04	<15
25	0.05	20
30	0.08	24
35	0.11	31
40	0.14	35

1 = D.T.D. (Design Temperature Differential) is the difference between primary entering air temperature and designed room temperature.
 2 = Data reflects performance for standard 24" x 48" module with 9 3/4" dia. top inlet with volume adjustment valve in full open position.
 3 = Static pressure measured in inches of water.
 4 = The diffuser testing was performed in accordance with the ASHRAE 70 and 113.
 5 = N.C. Level reflects a 10 dB room attenuation (industry standard attenuation factor).

HLC-CLF LAMINAR FLOW DIFFUSER PERFORMANCE DATA

(45-65 CFM/FT²) 23% FREE AREA

Table 1: Airflow Performance Data

AVERAGE VELOCITIES BELOW MODULES @ 5°F D.T.D. ¹						
FACE VELOCITY (CFM/FT ²) ²	DISTANCE BELOW FACE (FT)					
	1	2	3	4	5	6
45	70	72	60	57	55	47
50	76	79	70	69	68	60
55	81	82	76	78	77	69
60	91	94	90	89	86	80
65	101	103	100	97	94	86

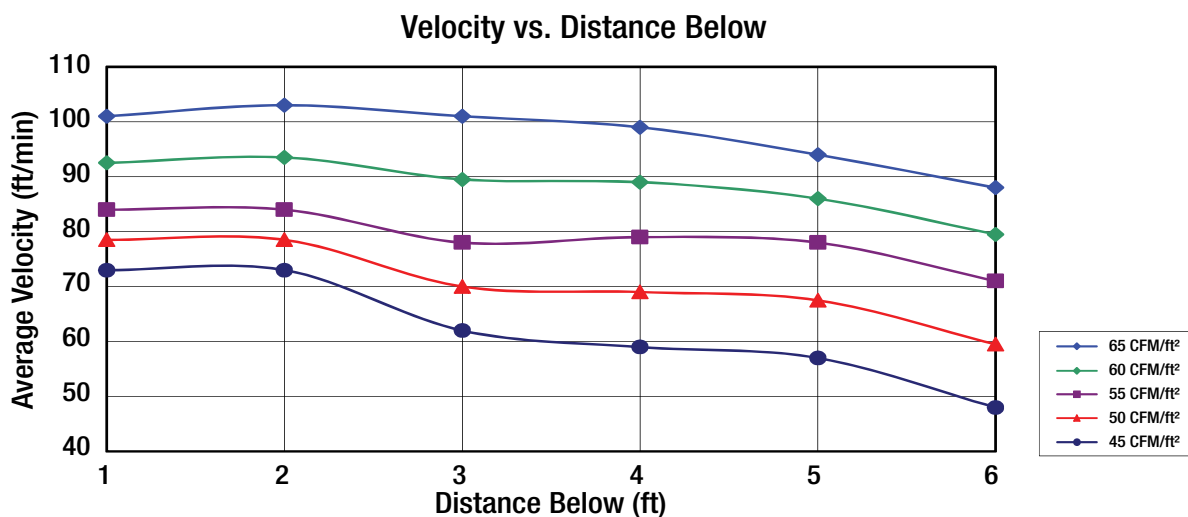


Table 2: Static Pressure & Noise Measurement

STATIC PRESSURE AND SOUND LEVEL		
CFM/FT ²	DUCT APPLICATION	
	STATIC PRESSURE ^{3,4}	N.C. LEVEL ^{4,5}
45	0.14	35
50	0.18	39
55	0.20	41
60	0.24	42
65	0.27	45

1 = D.T.D. (Design Temperature Differential) is the difference between primary entering air temperature and designed room temperature.
2 = Data reflects performance for standard 24" x 48" module with 9 3/4" dia. top inlet with volume adjustment valve in full open position.
3 = Static pressure measured in inches of water.
4 = The diffuser testing was performed in accordance with the ANSI/ASHRAE Standard 70 and 113.
5 = N.C. Level reflects a 10 dB room attenuation (industry standard attenuation factor).

HLC-CLF LAMINAR FLOW DIFFUSER PERFORMANCE DATA

(70-130 CFM/FT²) 51% FREE AREA

Table 1: Airflow Performance Data

AVERAGE VELOCITIES BELOW MODULES @ 5°F D.T.D. ¹						
FACE VELOCITY (CFM/FT ²) ²	DISTANCE BELOW FACE (FT)					
	1	2	3	4	5	6
70	106	109	107	96	93	75
80	118	125	121	106	97	85
90	135	138	132	123	114	108
100	151	156	155	146	129	118
110	171	169	168	160	141	126
120	181	181	179	170	160	150
130	189	194	193	183	171	158

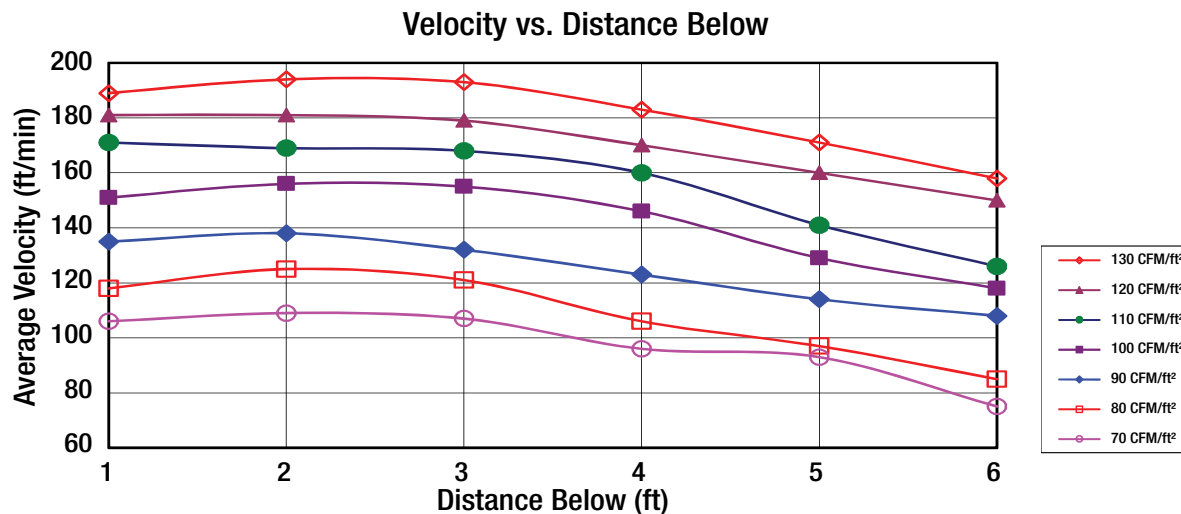
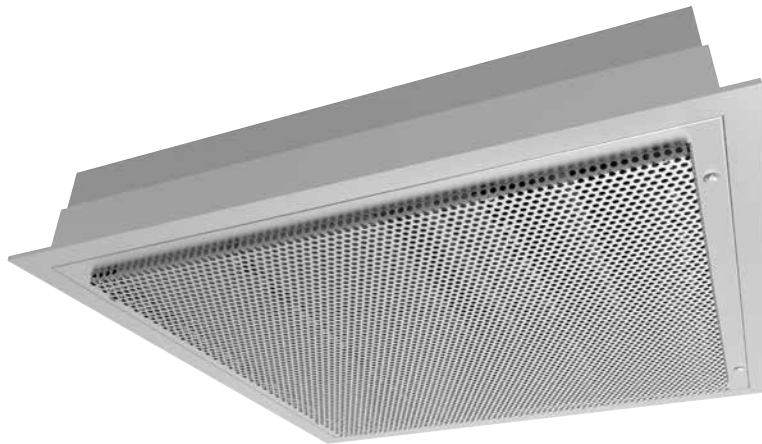


Table 2: Static Pressure & Noise Measurement

STATIC PRESSURE AND SOUND LEVEL		
CFM/FT ²	DUCT APPLICATION	
	STATIC PRESSURE ³	N.C. LEVEL ^{4,5}
70	0.21	41
80	0.28	45
90	0.36	48
100	0.45	52
110	0.54	54
120	0.66	56
130	0.76	58

1 = D.T.D. (Design Temperature Differential) is the difference between primary entering air temperature and designed room temperature.
 2 = Data reflects performance for standard 24" x 48" module with 13 3/4" dia. top inlet with volume adjustment valve in full open position.
 3 = Static pressure measured in inches of water.
 4 = The sound generation testing was performed in accordance with ANSI Standard S12.31-1990 "Precision Methods for the Determination of Sound Power Levels of Broad-Band Noise Sources in Reverberation Rooms."
 5 = N.C. Level reflects a 10 dB room attenuation (industry standard attenuation factor).



RADIAL FLOW DIFFUSERS

Model HLC-FFR radial discharge pattern diffusers are engineered to handle large volumes of air in confined spaces with maximum comfort and low room air velocities. The HLC-FFR is an excellent choice for cleanrooms and laboratories.

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HLC-GFR radial discharge pattern diffuser includes a gel seal HEPA filter rack and is engineered for supply air distribution in critical environments such as chemistry labs and cleanrooms.

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SERIES HLC-FFR

Aluminum Construction

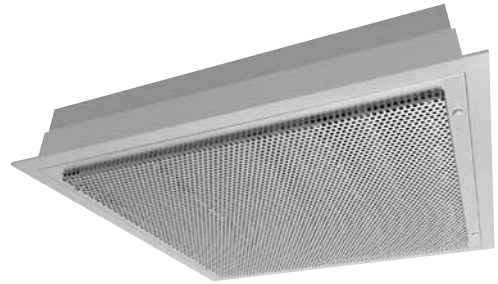
HLC-FFR-AL-1 – Surface Mount

HLC-FFR-AL-6 – Standard T-bar Lay-in

Stainless Steel Construction

HLC-FFR-SS-1 – Surface Mount

HLC-FFR-SS-6 – Standard T-bar Lay-in



Air outlets shall be model HLC-FFR-AL (aluminum) or HLC-FFR-SS (stainless steel) manufactured by GREENHECK. Diffuser shall include an upper and lower pressure chamber and shall generate a 180°, two-way, low velocity discharge pattern (optional: 90°, one-way discharge pattern).

Diffuser shall be constructed of a one-piece perforated face and core assembly that is removable from the backpan with quarter turn fasteners accessible from the face. Face and core assemblies mounted with internal spring clips or other mechanical fastening devices are not acceptable. Core Assembly to have nonadjustable pattern controllers mounted on the face assembly. Units shall include stainless steel safety chains attaching the face assembly to the backpan.

Core and face assembly shall be removable to allow sanitizing in an autoclave and allow access to the backpan for cleaning. With the core assembly removed, the inside of the backpan must be completely accessible for cleaning. Units with permanently fixed dampers, baffles or deflectors mounted in the backpan are not acceptable. Face shall project no further than 3/8" below the border of the diffuser. Perforated face shall have a 51% free area with 3/16" holes on 1/4" staggered centers. Units shall have round inlets. Units shall be designed to integrate into the specified ceiling system. The units shall be the size and quantity as outlined in the plans and specifications.

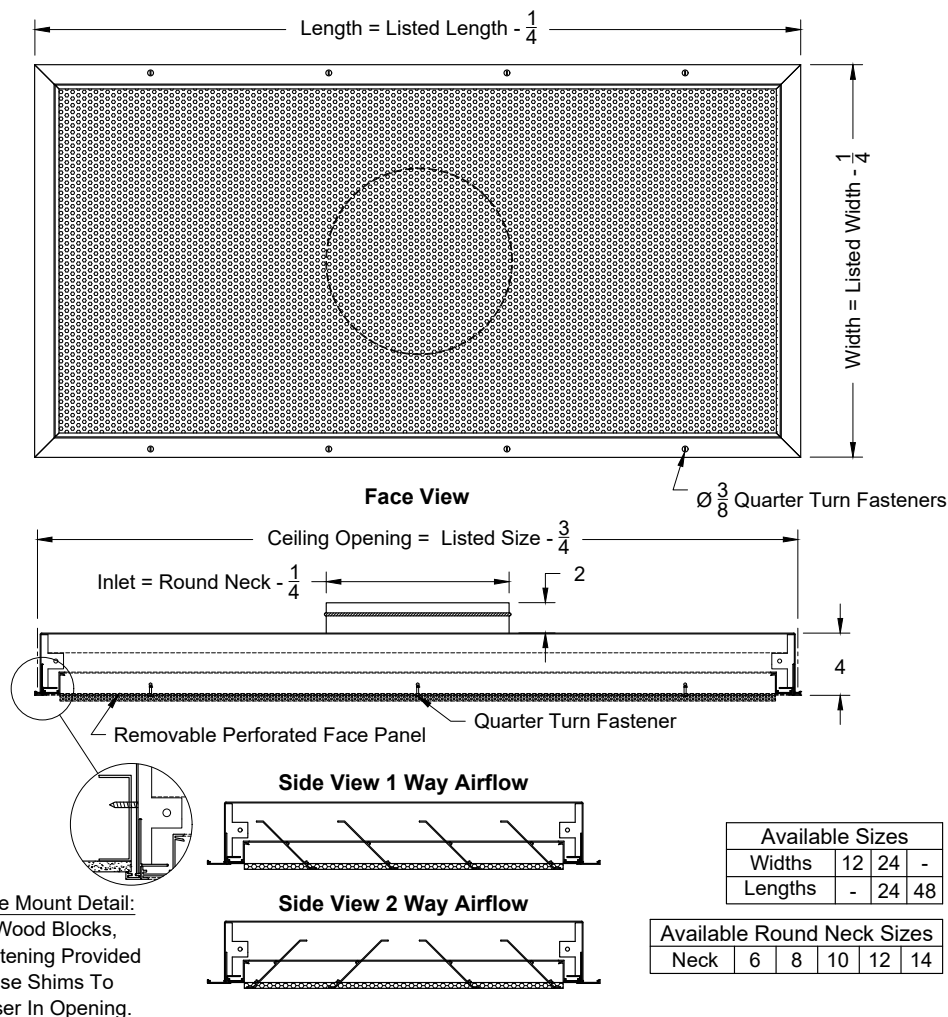
Performance Specification

The manufacturer shall provide published performance data. Data shall be tested in accordance to ANSI/ASHRAE Standard 70 and 113.

MODEL HLC-FFR-AL

Model: HLC-FFR-AL-1 Aluminum Face and Backpan - Flush Surface Mount

HLC-FFR-AL-1 - Flush Surface Mount



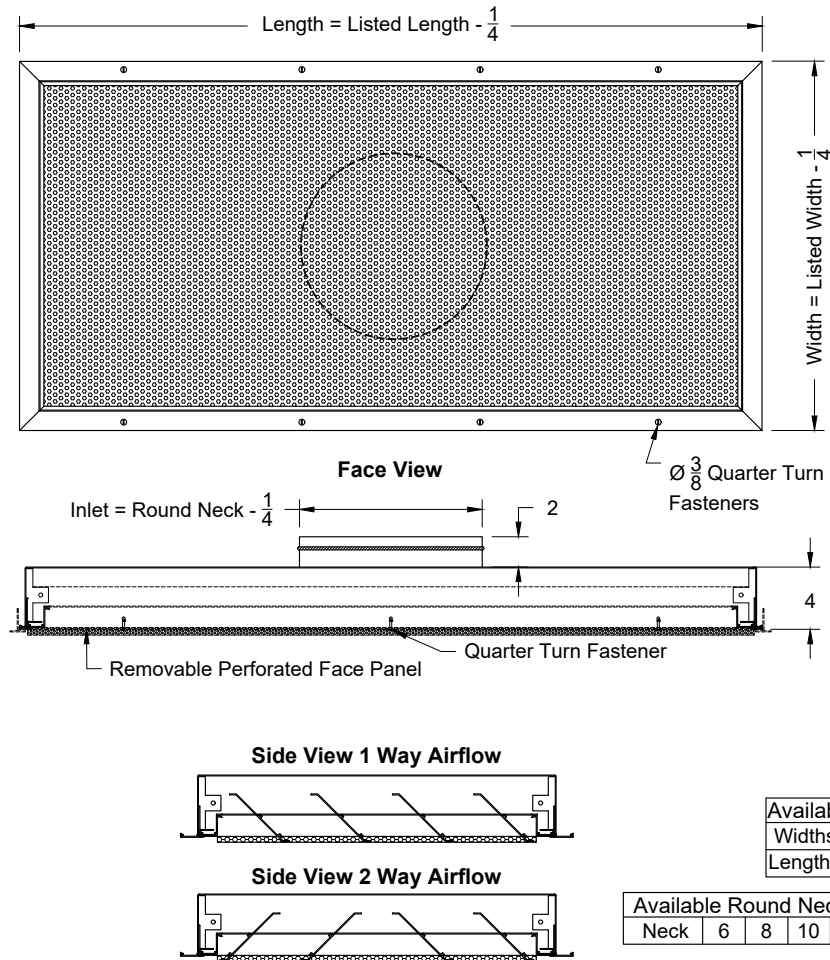
1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
Standard Finish: 01 White Finish 24 Mill Finish	XG-TBPF - T-Bar Plaster Frame XG-D3 - Radial Opposed Blade Damper	EI - External 1/2" Insulation	<ul style="list-style-type: none"> Spot Welded and Sealed Construction Perforated Panel Free Areas: 16%, 23% and 51% Available Available with 1 Way or 2 Way Air Flow Aluminum face and backpan

All Dimensions $\pm 1/16"$

MODEL HLC-FFR-AL

Model: HLC-FFR-AL-6 Aluminum Face and Backpan - T-Bar Lay In

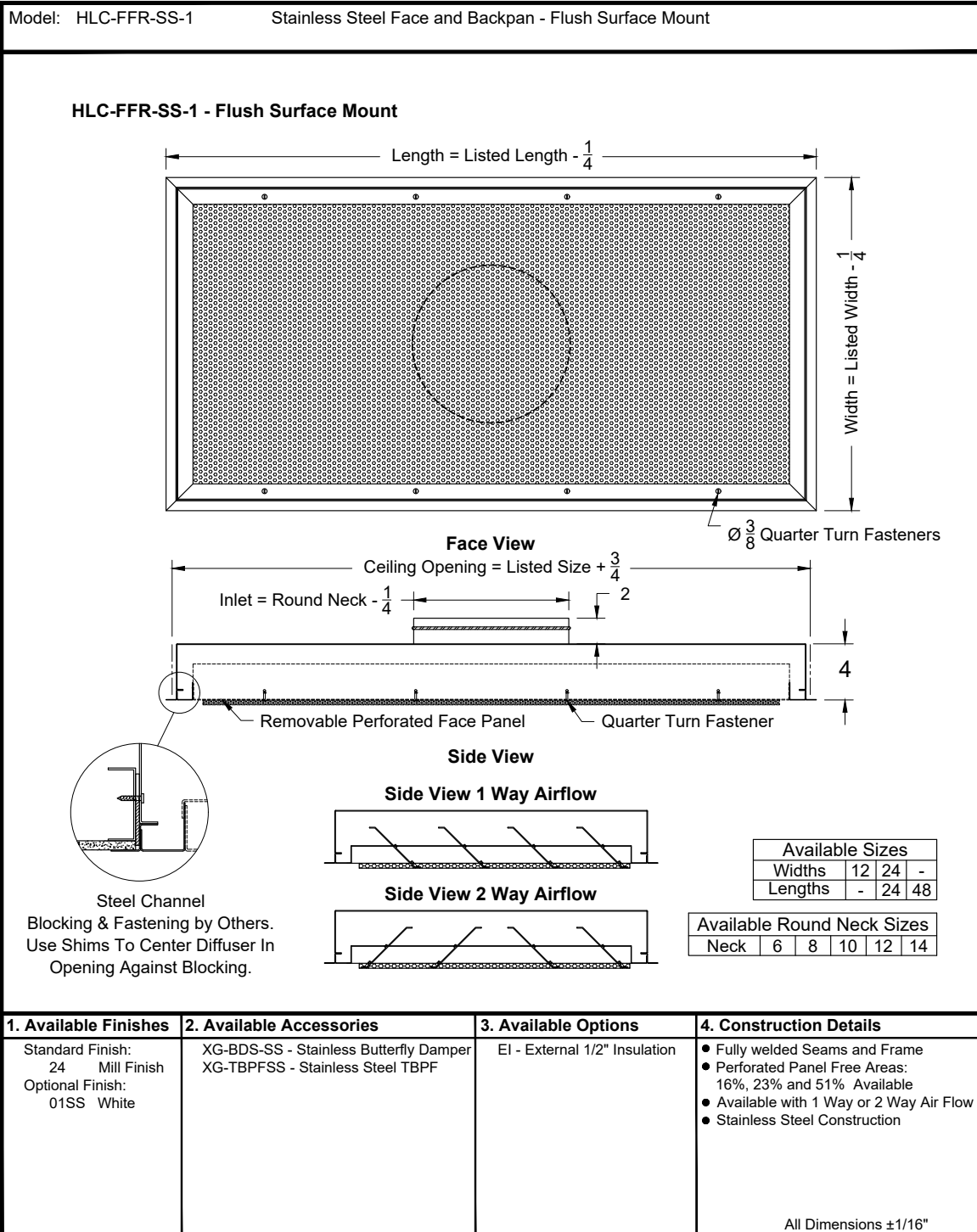
HLC-FFR-AL-6 - T-Bar Lay In



1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
Standard Finish: 01 White Finish 24 Mill Finish	XG-TBPF - T-Bar Plaster Frame XG-D3 - Radial Opposed Blade Damper	EI - External 1/2" Insulation	<ul style="list-style-type: none"> Spot Welded and Sealed Construction Perforated Panel Free Areas: 16%, 23% and 51% Available Available with 1 Way or 2 Way Air Flow Aluminum face and backpan

All Dimensions $\pm 1/16$ "

MODEL HLC-FFR-SS

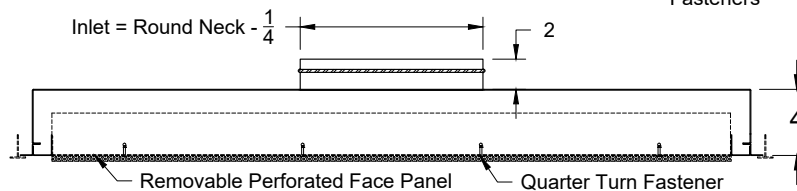
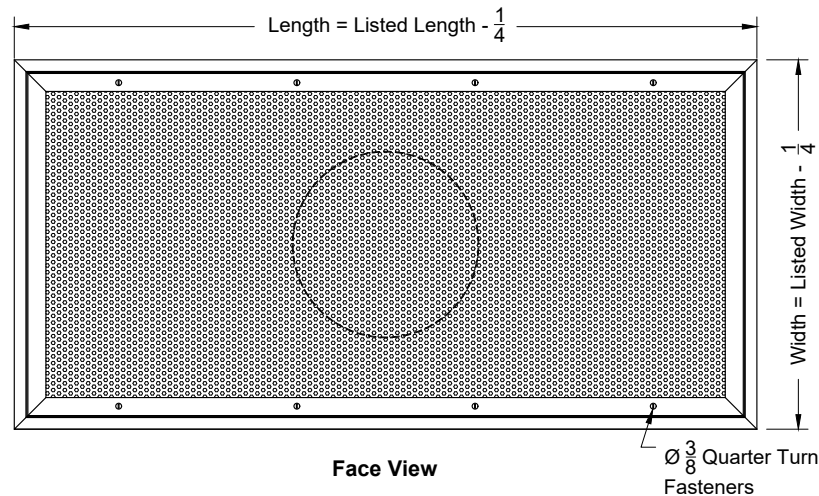


MODEL HLC-FFR-SS

Model: HLC-FFR-SS-6

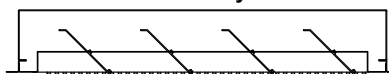
Stainless Face and Backpan - T-Bar Lay In

HLC-FFR-SS-6 - T-Bar Lay In

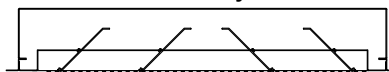


Side View

Side View 1 Way Airflow



Side View 2 Way Airflow



Available Sizes			
Widths	12	24	-
Lengths	-	24	48

Available Round Neck Sizes					
Neck	6	8	10	12	14

1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
Standard Finish: 24 Mill Finish Optional Finish: 01SS White	XG-BDS-SS - Stainless Butterfly Damper XG-TBPFSS - Stainless Steel TBPF	EI - External 1/2" Insulation	<ul style="list-style-type: none"> Fully welded Seams and Frame Perforated Panel Free Areas: 16%, 23% and 51% Available Available with 1 Way or 2 Way Air Flow Stainless Steel Construction

All Dimensions $\pm 1/16$ "

SERIES HLC-FFR PERFORMANCE

HLC-FFR — 1-WAY PATTERN

Module Size and Inlet Size	2-Way Pattern				Horizontal Spread (feet)			Vertical Throw (feet)								
	CFM	Ps	Pt	NC	10 Deg dT			10 Deg dT			15 Deg dT			20 Deg dT		
					100	75	50	100	75	50	100	75	50	100	75	50
24 x 24 8	150	.019	.030	<15	0	1	3	0	1	2	0	1	2	0	1	4
	200	.033	.054	<15	1	1	2	0	1	2	0	1	2	0	1	3
	250	.052	.084	18	1	2	5	1	2	4	1	2	5	1	3	6
	300	.075	.121	23	1	3	5	1	2	4	1	2	5	2	4	6
	400	.132	.214	32	2	4	6	2	3	5	2	4	6	3	5	7
	500	.207	.335	39	3	5	7	2	4	5	3	5	7	4	6	8
24 x 24 10	250	.019	.034	<15	1	2	5	0	0	1	1	1	3	1	1	3
	325	.033	.057	<15	1	3	6	0	1	2	1	2	4	1	1	4
	400	.052	.087	21	2	4	7	0	1	4	2	2	5	1	2	5
	475	.075	.122	27	3	5	8	1	1	4	2	3	5	1	3	5
	550	.132	.164	33	3	5	8	1	2	5	2	3	6	2	3	6
	625	.207	.212	37	4	6	9	1	2	5	2	4	7	2	4	7
48 x 24 10	300	.019	.049	<15	1	2	6	0	0	2	1	2	3	0	1	3
	400	.033	.087	19	2	4	7	0	1	3	1	2	5	1	1	5
	500	.052	.135	28	3	5	7	1	1	4	2	3	6	1	2	6
	600	.075	.196	34	4	6	8	1	2	5	2	3	7	1	3	7
	800	.132	.347	40	5	7	9	1	3	6	3	5	8	2	5	10
	900	.207	.439	41	6	7	10	2	3	7	3	5	9	3	6	10
48 x 24 12	500	.019	.074	19	1	2	5	1	1	4	1	1	6	1	3	6
	600	.033	.106	25	1	3	6	1	2	5	1	2	7	2	4	7
	700	.052	.145	30	2	3	7	1	3	6	1	3	8	2	4	9
	800	.075	.189	33	2	4	8	2	3	6	2	4	9	3	5	10
	900	.132	.239	39	3	4	8	2	4	7	2	5	10	4	5	11
	1000	.207	.295	42	3	5	9	3	4	8	3	6	10	4	6	11

PERFORMANCE NOTES FOR SERIES HLC-FFR

All data is tested in accordance with ANSI/ASHRAE 70 and 113.

DEFINITION OF UNITS

CFM Cubic Feet per Minute (air)

Pv Velocity pressure (inches of water column)

Pt Total pressure (inches of water column)

Ps Static pressure = Pt-Pv (inches of water column)

Throw Non-isothermal horizontal throw (supply air temperature 15°F colder than average room temperature); values are for 150, 100 and 50 fpm velocities

NC Noise criterion, sound pressure level NC ratings are based on sound power level (Lw) re: 10⁻¹² watts minus a 10 dB room attenuation in all octave bands

Note: Tests were conducted with 51% free area face panel.

Performance Correction Factors			
	16%	23%	51%
Throw	x 0.45	x 0.55	x 1.0
Pressure	x 2.45	x 2.20	x 1.0
NC Level	x 1.40	x 1.30	x 1.0

Please use the correction factors listed in the table to estimate data for units with 16% or 23% free area.

SERIES HLC-FFR PERFORMANCE

HLC-FFR — 2-WAY PATTERN

Module Size and Inlet Size	2-Way Pattern				Horizontal Spread (feet)			Vertical Throw (feet)								
	CFM	Ps	Pt	NC	10 Deg dT			10 Deg dT			15 Deg dT			20 Deg dT		
					100	75	50	100	75	50	100	75	50	100	75	50
24 x 24 8	150	.019	.030	<15	0	1	3	0	1	2	0	1	2	0	1	4
	200	.033	.054	15	1	1	4	0	1	3	0	1	4	1	2	5
	250	.052	.084	19	1	2	5	1	2	4	1	2	5	1	3	6
	300	.075	.121	23	1	3	5	1	2	4	1	2	5	2	4	6
	400	.132	.214	31	2	4	6	2	3	6	2	4	6	3	5	7
	500	.207	.335	39	3	5	7	2	4	6	3	5	7	4	6	8
24 x 24 10	250	.023	.036	<15	1	2	5	0	0	1	1	1	3	0	1	3
	325	.039	.061	<15	1	3	6	0	1	2	1	2	4	1	1	4
	400	.092	.145	29	3	5	10	1	1	4	2	3	6	1	3	6
	475	.133	.208	36	4	6	11	1	2	5	2	3	7	2	3	7
	550	.181	.284	41	5	7	12	1	3	6	3	4	7	2	4	8
	625	.299	.469	45	6	9	14	2	4	8	3	5	8	3	5	9
48 x 24 10	300	.017	.030	<15	1	2	5	0	0	1	0	1	2	0	1	2
	400	.028	.050	<15	1	3	6	0	0	2	1	2	3	0	1	3
	500	.067	.119	26	3	5	10	1	1	4	2	2	5	1	2	5
	600	.096	.172	33	4	6	11	1	2	4	2	3	6	1	3	6
	800	.131	.234	38	5	7	12	1	2	5	2	3	6	2	3	7
	900	.217	.387	42	6	9	14	2	3	6	3	4	7	3	4	8
48 x 24 12	500	.067	.092	19	3	5	10	1	1	4	1	1	5	1	3	6
	600	.096	.133	25	4	6	11	1	2	4	1	2	6	2	3	7
	700	.131	.181	30	5	7	12	1	3	5	1	3	7	2	4	8
	800	.171	.236	33	5	8	13	2	3	7	2	4	7	3	5	9
	900	.217	.299	39	6	9	14	2	3	7	2	4	8	3	5	9
	1000	.268	.369	42	3	5	10	2	4	7	3	5	8	4	6	10

PERFORMANCE NOTES FOR SERIES HLC-FFR

All data is tested in accordance with ANSI/ASHRAE 70 and 113.

DEFINITION OF UNITS

CFM Cubic Feet per Minute (air)

Pv Velocity pressure (inches of water column)

Pt Total pressure (inches of water column)

Ps Static pressure = Pt-Pv (inches of water column)

Throw Non-isothermal horizontal throw (supply air temperature 15°F colder than average room temperature); values are for 150, 100 and 50 fpm velocities

NC Noise criterion, sound pressure level NC ratings are based on sound power level (Lw) re: 10⁻¹² watts minus a 10 dB room attenuation in all octave bands

Note: Tests were conducted with 51% free area face panel.

Performance Correction Factors			
	16%	23%	51%
Throw	x 0.45	x 0.55	x 1.0
Pressure	x 2.45	x 2.20	x 1.0
NC Level	x 1.40	x 1.30	x 1.0

Please use the correction factors listed in the table to estimate data for units with 16% or 23% free area.

SERIES HLC-GFR

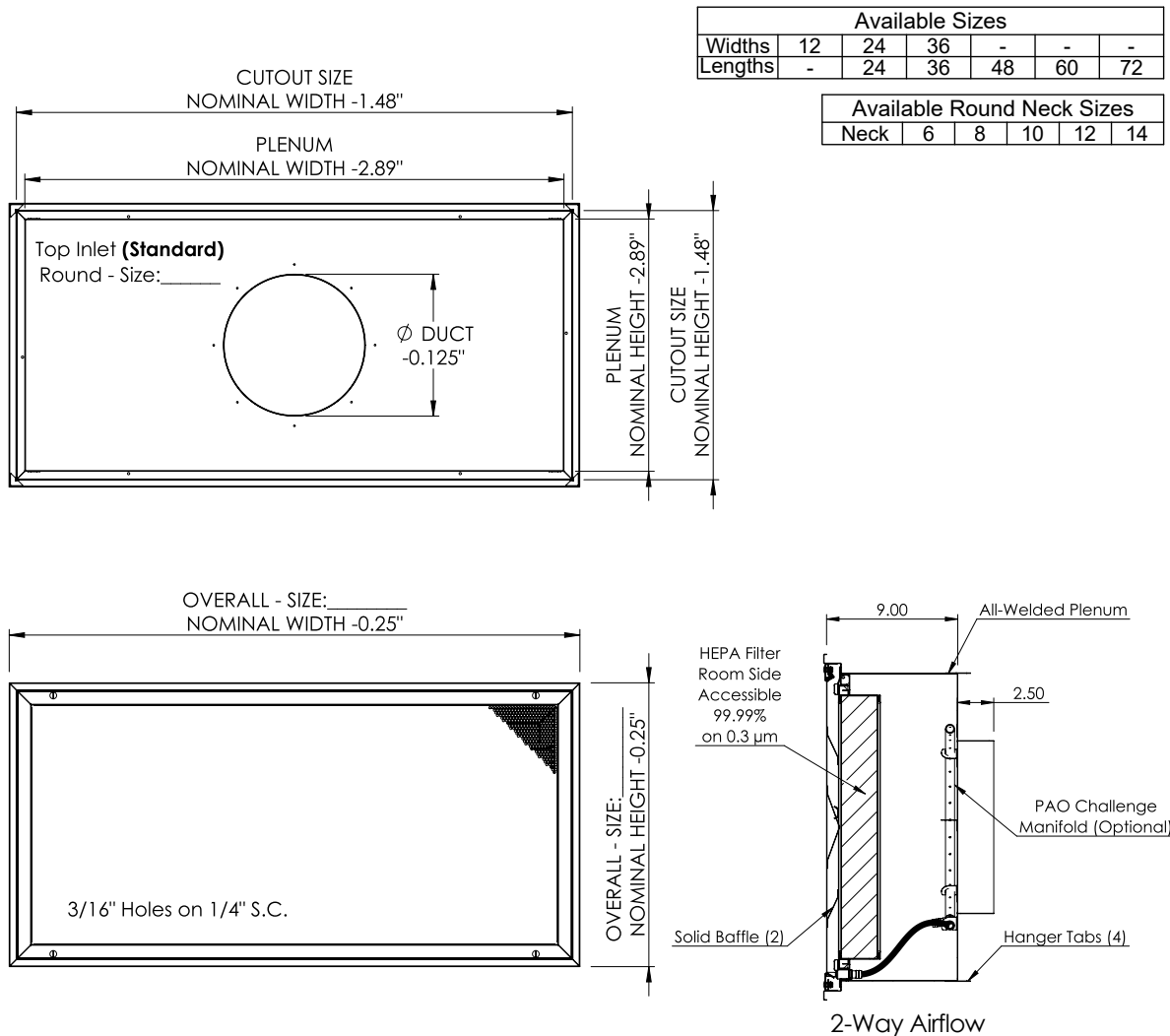
HLC-GFR radial discharge pattern diffuser includes a gel seal HEPA filter rack and is engineered for supply air distribution in critical environments such as chemistry labs and cleanrooms. The diffusers are engineered to supply a low velocity of conditioned air in a radial pattern from the ceiling.

- Low velocity radial air pattern
- Available in 90° or 180° throw
- Removable face to allow ease of cleaning and sterilization
- Choice of all aluminum, all cold-rolled steel or all stainless steel construction
- 51% free area
- Optional gel seal type HEPA filter
- Available in Surface Mount or T-bar Lay-in frame styles



MODEL HLC-GFR

Model: HLC-GFR-SS Radial Flow HEPA Diffuser – Stainless Steel Face and Backpan
HLC-GFR-AL Radial Flow HEPA Diffuser – Aluminum Face and Stainless Steel Backpan

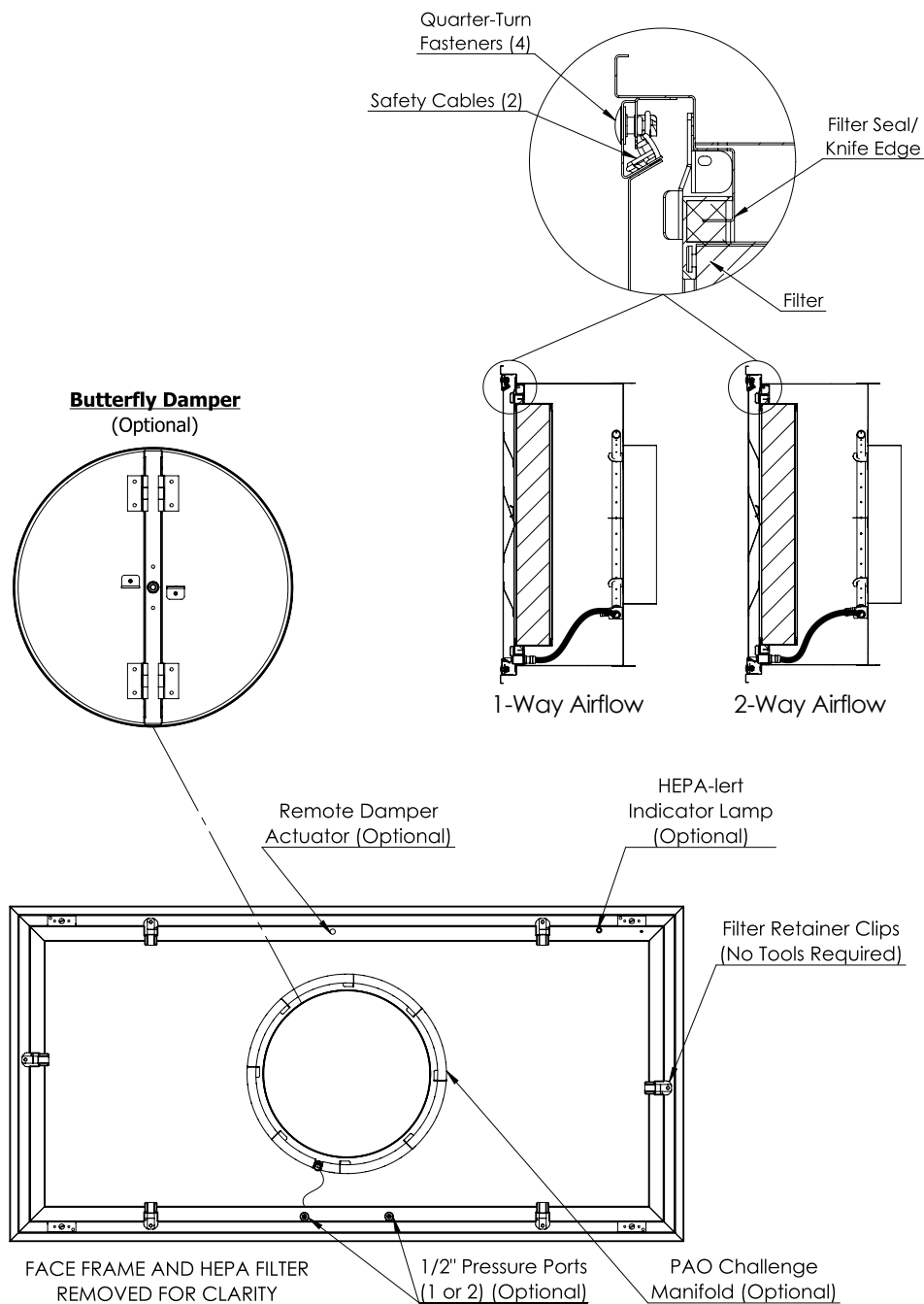


1. Available Finishes	2. Available Accessories	3. Available Options	4. Construction Details
01 White 01 SS White 24 Mill Finish 23 Satin Polish	COBD - Cable Operated Damper TBPF - T-Bar Plaster Frame	TP - Test Port ADM - Aerosol Distribution Manifold HAK - HEPA Alert Kit EI - External 1/2" Insulation	<ul style="list-style-type: none"> Fully welded seams and frame 304SS, 316SS, and Aluminum Classified as ASHRAE Group E Non-Aspirating Diffuser, Compliant with ASHRAE 170 Requirements Roomside Replaceable HEPA Filter Factory IEST Leakage testing available Perforated Panel Free Areas: 16%, 23% and 51% Available Gel seal HEPA Filter available separately

All Dimensions ±1/16"

MODEL HLC-GFR

Model: HLC-GFR Radial Flow HEPA Diffuser Details



HLC-GFR – 1-WAY PATTERN WITHOUT HEPA FILTER

Module Size and Inlet Size	1-Way Pattern				Vertical Throw (feet)			Horizontal Spread (feet)		
	CFM	Ps	Pt	NC	100	75	50	100	75	50
24 x 24	250	.058	.089	19	1	2	3	2	3	5
	400	.130	.211	32	2	3	4	4	5	7
	500	.210	.340	39	2	3	4	6	7	8
48 x 24	250	.024	.037	<15	0	0	1	3	4	6
	400	.054	.088	22	0	1	2	6	7	9
	550	.100	.163	33	2	3	4	8	9	10

HLC-GFR – 2-WAY PATTERN WITHOUT HEPA FILTER

Module Size and Inlet Size	2-Way Pattern				Vertical Throw (feet)			Horizontal Spread (feet)		
	CFM	Ps	Pt	NC	100	75	50	100	75	50
24 x 24	250	.056	.088	19	1	2	4	1	3	5
	400	.143	.225	32	2	3	4	5	6	7
	500	.212	.340	39	2	4	5	6	7	8
48 x 24	250	.023	.036	<15	1	1.5	2	0	3.5	5
	500	.087	.139	29	1	1.5	2.5	5	7	10
	700	.145	.248	38	1	1.5	2.5	6	8	10

PERFORMANCE NOTES FOR SERIES HLC-GFR

All data is tested in accordance with ANSI/ASHRAE 70 and 113.

DEFINITION OF UNITS

CFM Cubic Feet per Minute (air)

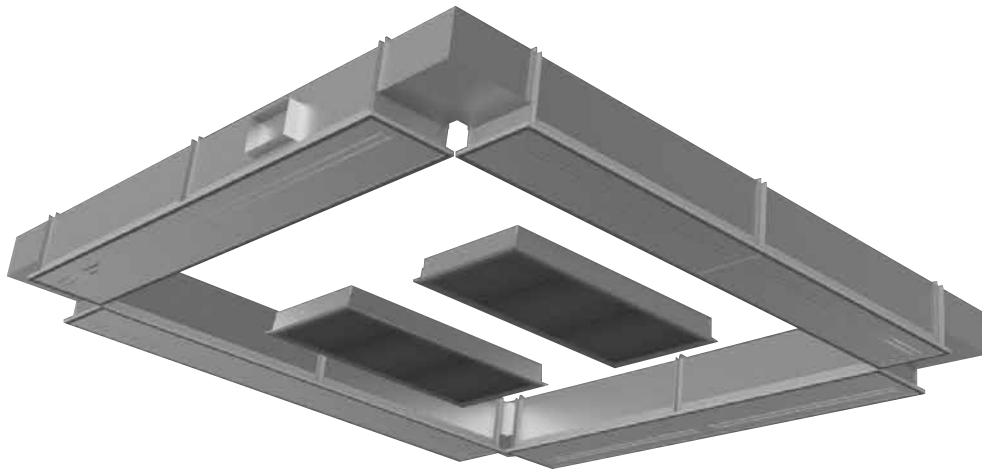
Pv Velocity pressure (inches of water column)

Pt Total pressure (inches of water column)

Ps Static pressure = Pt-Pv (inches of water column)

Throw Non-isothermal horizontal throw (supply air temperature 15°F colder than average room temperature); values are for 150, 100 and 50 fpm velocities

NC Noise criterion, sound pressure level NC ratings are based on sound power level (Lw) re: 10⁻¹² watts minus a 10 dB room attenuation in all octave bands



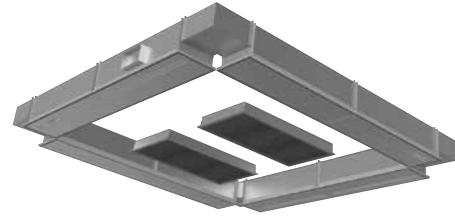
SURGICAL AIR CURTAIN

The Greenheck HLC-SAC System is intended for use in hospital operating rooms. The compact yet efficient design provides control over particulate matter within the operating room environment. The high velocity air discharged from the slots creates a barrier preventing airborne particulates from entering the sterile field created by the primary supply diffuser array.

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HLC-SAC

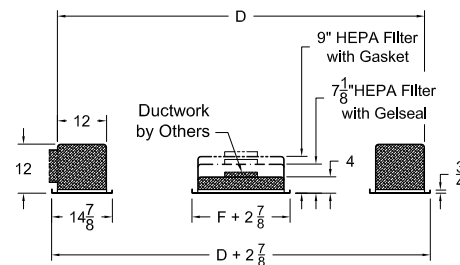
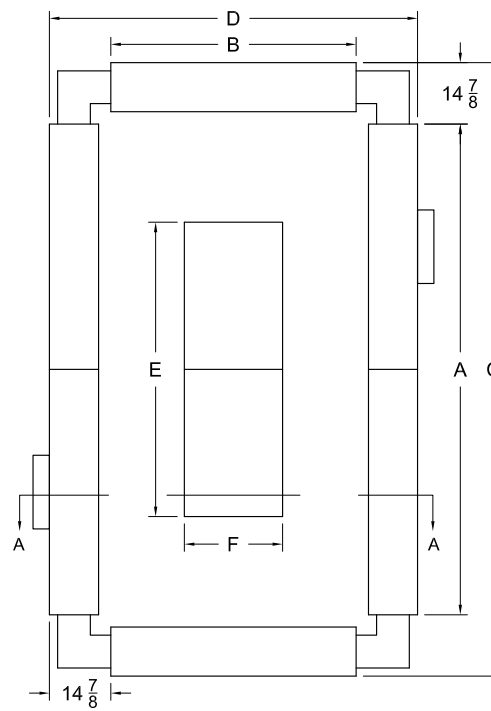
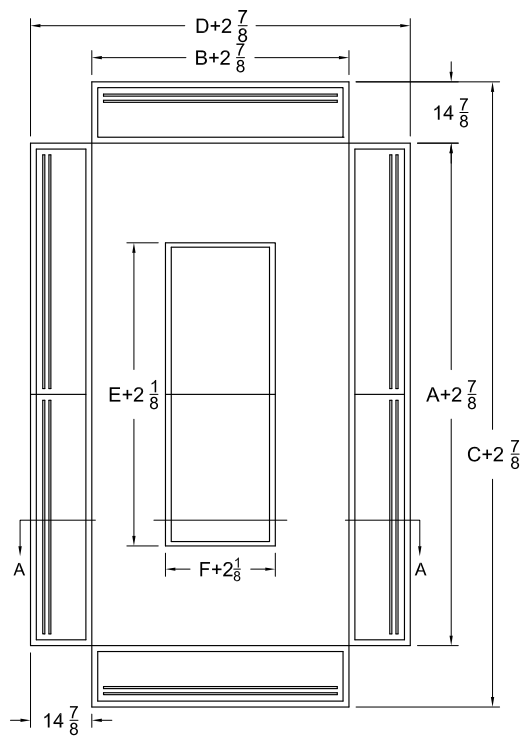
Hospital Operating Room Air Curtain System



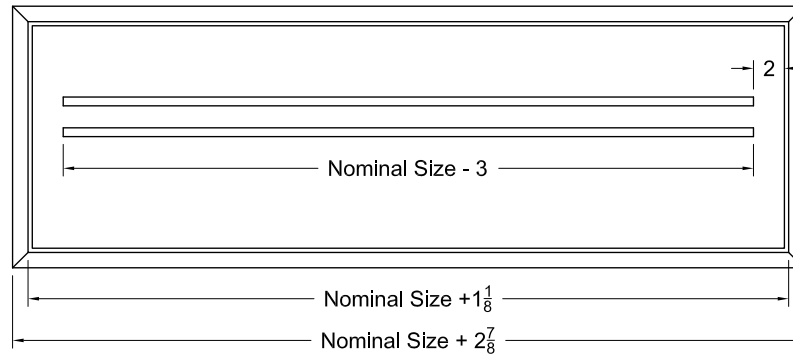
1. Air distribution and particle control for the operating room(s) shall consist of a non-aspirating center panel(s) providing air supply over the operating table. The air velocity from the center panel(s) shall not exceed 35 cfm/ft². An air curtain shall be provided from fixed, nonadjustable multiple slot panels surrounding the operating table height. This air curtain shall not exceed 60 fpm or be of a laminar pattern but shall project air outward at not less than a 5-degree angle, but no more than a 15-degree angle, outward from the operating table with a temperature differential between supply and ambient room temperature of 0 to 20 degrees Fahrenheit (cooling). Systems that do not contain an air curtain as an inherent part of their design shall not be acceptable.
2. All components of the system shall be fabricated of stainless steel. All ductwork supplied by the contractor from the HEPA filters to the system shall be provided to permit manual sterilization of the ductwork. Factory-supplied plenums shall be constructed of a minimum of 20-gauge Type 304 (18-8) stainless steel with a 3/4 inch radius for ease of sterilization. The center panel(s) shall be constructed of 20-gauge Type 304 stainless steel. The perimeter panel(s) shall be constructed of a minimum 18-gauge Type 304 stainless steel. All exposed surfaces shall be supplied with #4 (scratch) finish. All interior surfaces shall be supplied with #2B (smooth) finish to prevent the accumulation of particulate matter. Systems using materials other than stainless steel or supplying component with a painted or coated finish shall not be acceptable.
3. The contractor shall supply manual balancing dampers at each inlet connection to the system also constructed of a minimum of 20-gauge stainless steel. Each center panel shall be provided with a single inlet connection and the perimeter plenum system shall be supplied with two inlet connections. Systems utilizing more than two inlet connections to the perimeter plenum shall not be acceptable.
4. A stainless steel perforated pressure plate supplied by the system manufacturer shall be permanently attached to both the center and perimeter panels to provide equal air distribution over the diffuser face. Both center and perimeter panels shall be retained by quarter turn fasteners for ease of removal for sterilization. The manufacturer shall supply clip-on safety cables to retain the face panels after the quarter turn fasteners are released.
5. An installation shall have been tested in accordance with the "Recommended Procedure for the Determination of Microbiological Air Cleanliness," as published by the Committee on Operating Room Environment of the American College of Surgeons (January 1976 bulletin) by an Independent Microbiological Testing Laboratory. The proposed system shall have met the requirements for Class 1 Microbiological Air Cleanliness as set forth in this procedure. Copies of the Independent Laboratory's test report shall be provided to the engineer for prior approval. The manufacturer shall submit a listing of 25 or more systems of the setup as shown.
6. The air distribution and airborne particle control system for the operating room(s) shall be the HLC-SAC Operating Room System as manufactured by GREENHECK or approved equal.

Performance Specification

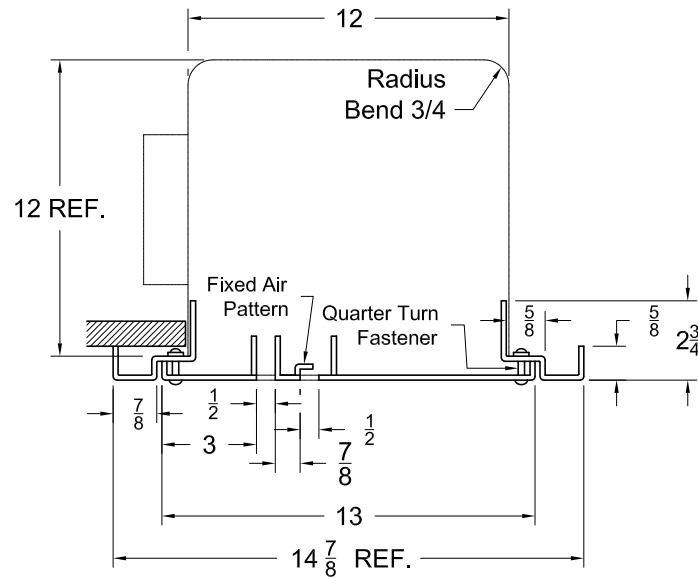
The manufacturer shall provide published performance data. Data shall be tested in accordance to ANSI/ASHRAE Standard 70 and 113.



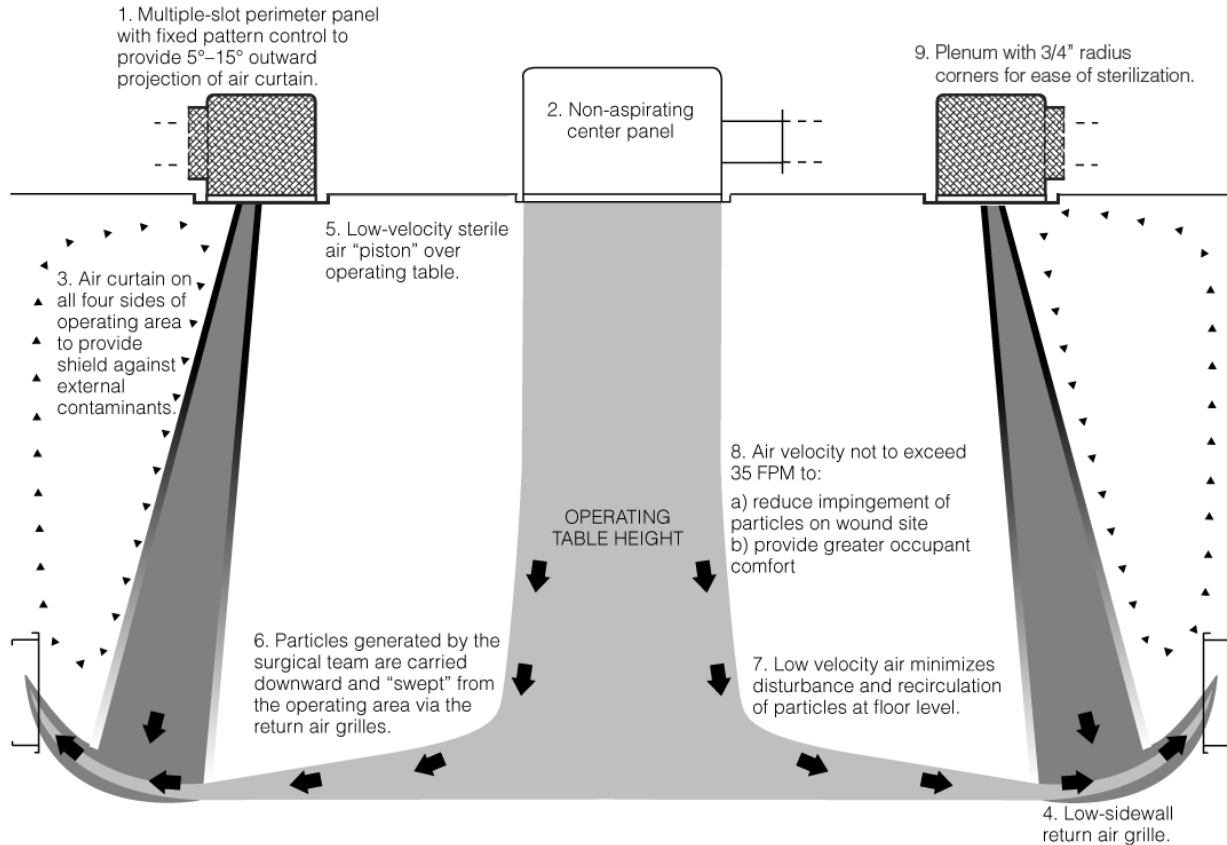
Model	Nominal Plenum Size		Overall Foot Print		Center Diffusers				System CFM Range	
	A	B	C	D	Over All		Qty	Size	Minimum	Maximum
					E	F				
84	96	48	A + 30	B + 30	60	24	1	60 x 24	900	1620
104	120	48			72	24	2	36 x 24	1050	1890
124	144	48			96	24	2	48 x 24	1200	2160
85	96	60			60	24	1	60 x 24	980	1760
105	120	60			96	24	2	48 x 24	1130	2030
125	144	60			96	24	2	48 x 24	1280	2300
66	72	72			48	36	2	36 x 24	900	1620
86	96	72			48	48	2	48 x 24	1050	1890
106	120	72			48	48	2	48 x 24	1200	2160
126	144	72			96	24	2	48 x 24	1350	2430
88	96	96			48	48	2	48 x 24	1200	2160
108	120	96			96	24	2	48 x 24	1350	2430
128	144	96			72	48	3	48 x 24	1500	2700
148	168	96			72	48	3	48 x 24	1650	2970
1010	120	120			72	48	3	48 x 24	1500	2700
1210	144	120			72	48	3	48 x 24	1650	2970



Face View (Both Models)



HLC-SAC SYSTEM



HLC-SAC SYSTEM PERFORMANCE DATA

CENTER PANEL

CFM per sq. ft.	10	20	30	40	50	60	70	80
Ps	0.06	0.13	0.21	0.30	0.40	0.48	0.58	0.69
NC	< 20	< 20	23	26	32	34	39	42
Velocity at 6-ft (single panel)	20	35	50	65	70	80	90	100
Velocity at 6-ft (multi-panels 1)	20	35	50	70	80	90	100	110
Velocity at 6-ft (multi-panels 2)	25	40	60	80	100	110	120	130

PERFORMANCE NOTES FOR HLC-SAC SYSTEM — CENTER PANEL

All data is tested in accordance with ANSI/ASHRAE 70-2006.

DEFINITION OF UNITS

CFM Cubic Feet per Minute (air)

Ps Static pressure = $P_t - P_v$ (inches of water column)

Throw vertical throw at a 50 fpm terminal velocity and temperature differential of 15°

NC Noise criterion, sound pressure level NC ratings are based on sound power level (Lw) re: 10^{-12} watts minus a 10dB room attenuation in all octave bands maximum inlet velocity of 500 fpm. NC based on center panel area of 4 square feet. To calculate NC for other panel areas, add the result of the following equation to the NC value from table above: NC adjustment = $10 \times \log(\text{multi-panel area} / 4)$
 Multi-panels 1 - Average velocity at 6 feet for adjacent panels totaling 15 to 30 square feet
 Multi-panels 2 - Average velocity at 6 feet for adjacent panels totaling more than 30 square feet

HLC-SAC PERFORMANCE DATA

CFM per linear ft.	20	25	30	35	40	45	50	55	60
Ps	0.024	0.030	0.036	0.050	0.064	0.078	0.091	0.109	0.127
Throw (ft)	5	5	6	7	7	8	8	9	9
NC	< 15	< 15	< 15	16	17	19	21	24	27

PERFORMANCE NOTES FOR HLC-SAC

All data is tested in accordance with ANSI/ASHRAE 70 and 113.

DEFINITION OF UNITS

CFM Cubic Feet per Minute (air)

Ps Static pressure = $P_t - P_v$ (inches of water column)

Throw Vertical throw at a 50 fpm terminal velocity and temperature differential of 15°

NC Noise criterion, sound pressure level NC ratings are based on sound power level (Lw) re: 10^{-12} watts minus a 10 dB room attenuation in all octave bands maximum inlet velocity of 500 fpm. NC based on center panel area of 4 square feet. To calculate NC for other panel areas, add the result of the following equation to the NC value from table above: NC adjustment = $10 \times \log(\text{multi-panel area} / 4)$

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