Diffractal®

The First Diffusing Fractal
From The Acoustical Industry's
Leading Innovator

In an effort to provide full spectrum sound diffusion in a single integrated diffusor, the self similarity property of fractals was combined with the uniform scattering property of the number theoretic reflection phase grating to produce the Diffractal,® a patented diffusing fractal.

RPG®

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

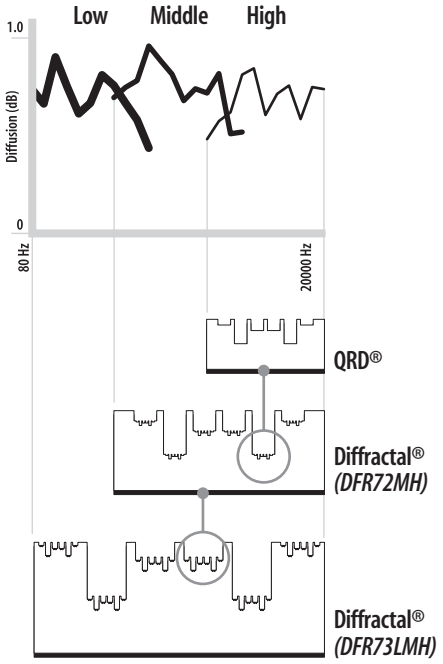
Problem and Solution

Problem

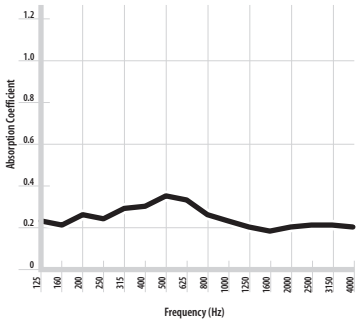
The bandwidth of a QRD® is limited at high frequencies by the well width and at low frequencies by the maximum depth. Additionally, wide area coverage with periodic arrays focuses energy into certain diffraction directions. A full spectrum diffusor offering wide area coverage is needed.

Solution

The Diffractal® is the first diffusing fractal. It consists of nested self similar scaled diffusors, each of which covers a specific frequency range and offers wide area coverage without lobing effects. A second generation Diffractal® (DFR72) contains two nested QRD®s, thus forming a diffusor within a diffusor. Each diffusor provides uniform scattering over a specific range of frequencies so that the effective bandwidth is extended. The DFR72 can be nested within a larger low frequency diffusor to provide wide area coverage, extended low frequency diffusivity, and also minimum lobing associated with periodic arrays. This third generation Diffractal® (DFR73) offers low, mid, and high frequency diffusion over an extended bandwidth, limited only by the depth available.

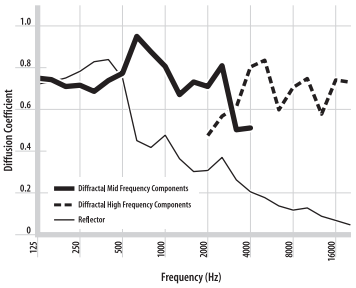


Performance Specifications



Absorption

Diffusors essentially scatter sound, but absorption may occur from wave resonances within the wells when they are narrow and deep and viscous losses due to pressure gradient induced air particle flows between adjacent wells. The Diffractal® provides high frequency diffusion without adding additional absorption by replacing the mid frequency QRD® wells with nested reduced scale high frequency QRD®s.



Diffusion

The nested diffusors comprising the Diffractal® extend the high frequency diffusive performance beyond that of the QRD® 734. The graph illustrates how the Diffractal® mid frequency and high frequency nested components essentially boot strap the uniform diffusion from 500 Hz to 20 kHz. The diffusion coefficient is also compared to a flat reflective panel which exhibits decreasing diffusivity with increasing frequency.

Installation

The Diffractal® can be flush mounted into an opening or surface mounted on a wall or ceiling.

FEATURES

- *Fractal surface*
- *Amplitude modulated QRD®*
- *Wide area coverage*
- *Modularity*
- *Furniture grade fabrication*

BENEFITS

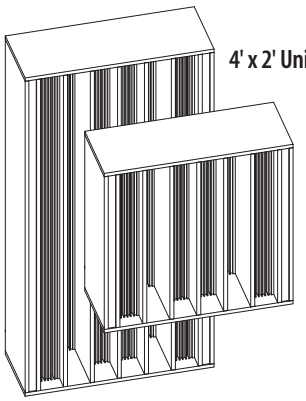
- *Fractal surface consisting of nested self similar low, mid, and high frequency QRD®s offers extended bandwidth Lobing effects due to periodicity are minimized by amplitude modulating the QRD® number theory sequence*
- *Amplitude modulation also permits wide area coverage without loss of performance due to periodicity effects*
- *The modular construction allows for fast and easy installation*
- *The furniture grade quality coupled with the wide variety of wood species and finishes make the Diffractal® an aesthetically pleasing addition to any space*

APPLICATIONS

Recording studios, Post production studios, Broadcast studios, Mastering studios, Listening rooms, Home theaters, Performing arts facilities, Conference rooms

SPECIFICATIONS

- *Sizes and weights:*
  23-5/8" (H) x 23-5/8" (W) x 9-1/8" (D): 26 lbs.
  47-1/4" (H) x 23-5/8" (W) x 9-1/8" (D): 50 lbs.
- *Custom heights up to 8' are available*
- *Standard finish: Uniform white birch clear coat*
- *Custom wood species and finishes available*
- *The species and finish of the wells and dividers may be different, offering additional design options.*



Standard Unit Construction

Rotary Cut, Uniform White Birch
Clear Coat
4' height x 2' width nominal (3' 11-1/4" x 1' 11-5/8") x 9-1/8" deep
1/2" Class A Fire Rated Flake Core

Product Options*, **

Custom units can be supplied with contrasting well and divider species and finishes

Veneer Selection
Resin filled particleboard (paint ready)
Uniform White Birch
Soft White Maple
Red Oak
White Oak
White Ash
Honduran Mahogany
American Cherry
Custom wood species (based on availability)
Melamine wood grain or solid color (not Class A Fire Rated)

Finish Selection
Unfinished
Clear Coat only (satin lacquer finish)
Stained and unfinished
Stained and clear coat
Painted

Unit Size
Units can be made with any height up to 8'
Units can be made with widths between 19" and 26"
Units can be made with depths between 4" and 12"

End Conditions
End Well/End Well (EE)
End Well/Half Well (EH)
End Well/Joining Well (EJ)
Half Well/Half Well (HH)
Half Well/Joining Well (HJ)
Joining/Joining (JJ)

Option Sheet

Note:

All dimensions are allowed a tolerance of ± 1/16" due to material shrinkage and variations.

** Most options merit an increase or, in some cases, a decrease in pricing compared to the standard unit.*

*** Due to material availability, RPG® reserves the right to change options at any time. Therefore, any special options—whether listed or not—must be confirmed prior to submittal of P.O. and acceptance verified by RPG® Diffusor Systems, Inc.*

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Wood One Dimensional Diffractal

2' x 2' CSI Specifications

Last Updated: 12.1.98

A The Wood One Dimensional Diffractal shall be the model Diffractal® 72MH 2' x 2' as manufactured by RPG® Diffusor Systems, Inc., Upper Marlboro, MD 20774. Tel: 301-249-0044, Fax: 301-249-3912.

B The Wood One Dimensional Diffractal shall be fabricated with a 1/2" Class A birch veneer Duraflake and solid hard wood birch inserts.

C The Wood One Dimensional Diffractal shall work on the one dimensional diffusing fractal reflection phase grating principle, using an array of wells of equal widths separated by thin dividers containing self similar inserts which conform to the number theoretic reflection phase grating principle. The depths of the wells for each nested Wood One Dimensional Diffractal shall be based on the prime 7 quadratic residue theory sequence, modulated by the quadratic depth sequences of the other self-similar Wood One Dimensional Diffractal.

D Sound diffusion in the horizontal plane shall be provided by wells in the vertical position while diffusion in the vertical plane shall be provided by wells in the horizontal position. The self similar diffusing elements shall be orthogonal, which allows the polar response of each band limited Wood One Dimensional Diffractal to be equal to what is operating independently, providing ideal diffusion in each frequency range. The Wood One Dimensional Diffractal may be rotated to achieve a variety of patterns that will provide a highly effective scattering surface.

E Absorption Coefficients and Noise Reduction Coefficient for the product shall be measured by an independent, accredited NVLAP facility according to the test methods as defined by ASTM C 423 and ASTM E 795. Random incidence Absorption Coefficients for the product in an Type A mounting shall be as follows:

125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	NRC
0.23	0.24	0.35	0.23	0.20	0.20	0.25

F Diffusion Coefficients for the product shall be measured in accordance with the recommendations of the Audio Engineering Society Working Group SC-04-02 boundary measurement technique. The directional diffusion coefficient is given by the standard deviation of the 1/3-octave polar response, for a given angle of incidence, and normalized by the response of a flat panel of similar size. The normal incidence diffusion coefficients determined at 5° intervals between ± 85° are listed below at octave-band centers. The mean and standard deviation (SD) of the 1/3-octave-band coefficients are also tabulated.

125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	Mean	SD
0.75	0.71	0.77	0.80	0.71	0.51	0.71	0.10

G Flame Spread and Smoke Developed shall be tested by an independent, accredited NVLAP facility according to the test methods as defined by ASTM E 84 and NFPA 255. The Wood One Dimensional Diffractal shall have a composite Flame Spread Rating of less than 25 and a Smoke Development of less than 450.

H The Wood One Dimensional Diffractal shall be supplied with a laquered finish.

I The overall dimensions shall be 23-5/8"(H) x 23-5/8"(W) x 9-1/8"(D) and weigh no more than 29 pounds.

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Wood One Dimensional Diffractal

4' x 2' CSI Specifications

A The Wood One Dimensional Diffractal shall be the model Diffractal® 72MH 4' x 2' as manufactured by RPG® Diffusor Systems, Inc., Upper Marlboro, MD 20774. Tel: 301-249-0044, Fax: 301-249-3912.

B The Wood One Dimensional Diffractal shall be fabricated with a 1/2" Class A birch veneer Duraflake and solid hard wood birch inserts.

C The Wood One Dimensional Diffractal shall work on the one dimensional diffusing fractal reflection phase grating principle, using an array of wells of equal widths separated by thin dividers containing self similar inserts which conform to the number theoretic reflection phase grating principle. The depths of the wells for each nested Wood One Dimensional Diffractal shall be based on the prime 7 quadratic residue theory sequence, modulated by the quadratic depth sequences of the other self-similar Wood One Dimensional Diffractal.

D Sound diffusion in the horizontal plane shall be provided by wells in the vertical position while diffusion in the vertical plane shall be provided by wells in the horizontal position. The self similar diffusing elements shall be orthogonal, which allows the polar response of each band limited Wood One Dimensional Diffractal to be equal to what is operating independently, providing ideal diffusion in each frequency range. The Wood One Dimensional Diffractal may be rotated to achieve a variety of patterns that will provide a highly effective scattering surface.

E Absorption Coefficients and Noise Reduction Coefficient for the product shall be measured by an independent, accredited NVLAP facility according to the test methods as defined by ASTM C 423 and ASTM E 795. Random incidence Absorption Coefficients for the product in an Type A mounting shall be as follows:

125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	NRC
0.23	0.24	0.35	0.23	0.20	0.20	0.25

F Diffusion Coefficients for the product shall be measured in accordance with the recommendations of the Audio Engineering Society Working Group SC-04-02 boundary measurement technique. The directional diffusion coefficient is given by the standard deviation of the 1/3-octave polar response, for a given angle of incidence, and normalized by the response of a flat panel of similar size. The normal incidence diffusion coefficients determined at 5° intervals between ± 85° are listed below at octave-band centers. The mean and standard deviation (SD) of the 1/3-octave-band coefficients are also tabulated.

125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	Mean	SD
0.75	0.71	0.77	0.80	0.71	0.51	0.71	0.10

G Flame Spread and Smoke Developed shall be tested by an independent, accredited NVLAP facility according to the test methods as defined by ASTM E 84 and NFPA 255. The Wood One Dimensional Diffractal shall have a composite Flame Spread Rating of less than 25 and a Smoke Development of less than 450.

H The Wood One Dimensional Diffractal shall be supplied with a laquered finish.

I The overall dimensions shall be 47-1/4"(H) x 23-5/8"(W) x 9-1/8"(D) and weigh no more than 56 pounds.

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Wood One Dimensional Diffractal

Custom CSI Specifications

A The Wood One Dimensional Diffractal shall be the model Diffractal® 72MH Custom as manufactured by RPG® Diffusor Systems, Inc., Upper Marlboro, MD 20774. Tel: 301-249-0044, Fax: 301-249-3912.

B The Wood One Dimensional Diffractal shall be fabricated with a 1/2" Class A _____ (specify suitable veneered finish) veneer Duraflake and solid hard wood _____ (specify other suitable hard wood) inserts.

C The Wood One Dimensional Diffractal shall work on the one dimensional diffusing fractal reflection phase grating principle, using an array of wells of equal widths separated by thin dividers containing self similar inserts which conform to the number theoretic reflection phase grating principle. The depths of the wells for each nested Wood One Dimensional Diffractal shall be based on the prime 7 quadratic residue theory sequence, modulated by the quadratic depth sequences of the other self-similar Wood One Dimensional Diffractal.

D Sound diffusion in the horizontal plane shall be provided by wells in the vertical position while diffusion in the vertical plane shall be provided by wells in the horizontal position. The self similar diffusing elements shall be orthogonal, which allows the polar response of each band limited Wood One Dimensional Diffractal to be equal to what is operating independently, providing ideal diffusion in each frequency range. The Wood One Dimensional Diffractal may be rotated to achieve a variety of patterns that will provide a highly effective scattering surface.

E Absorption Coefficients and Noise Reduction Coefficient for the product shall be measured by an independent, accredited NVLAP facility according to the test methods as defined by ASTM C 423 and ASTM E 795. Random incidence Absorption Coefficients for the product in an Type A mounting shall be as follows:

125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	NRC
0.23	0.24	0.35	0.23	0.20	0.20	0.25

F Diffusion Coefficients for the product shall be measured in accordance with the recommendations of the Audio Engineering Society Working Group SC-04-02 boundary measurement technique. The directional diffusion coefficient is given by the standard deviation of the 1/3-octave polar response, for a given angle of incidence, and normalized by the response of a flat panel of similar size. The normal incidence diffusion coefficients determined at 5° intervals between ± 85° are listed below at octave-band centers. The mean and standard deviation (SD) of the 1/3-octave-band coefficients are also tabulated.

125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	Mean	SD
0.75	0.71	0.77	0.80	0.71	0.51	0.71	0.10

G Flame Spread and Smoke Developed shall be tested by an independent, accredited NVLAP facility according to the test methods as defined by ASTM E 84 and NFPA 255. The Wood One Dimensional Diffractal shall have a composite Flame Spread Rating of less than 25 and a Smoke Development of less than 450.

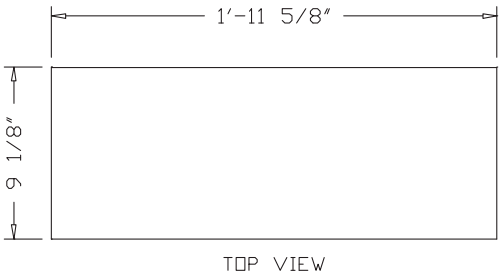
H The Wood One Dimensional Diffractal shall be supplied with a _____finish (specify suitable finish).

I The overall dimensions shall be 47-1/4"(H) x 23-5/8"(W) x 9-1/8"(D) and weigh no more than 56 pounds.

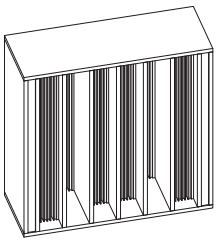
*The **Sound** of **Innovation***

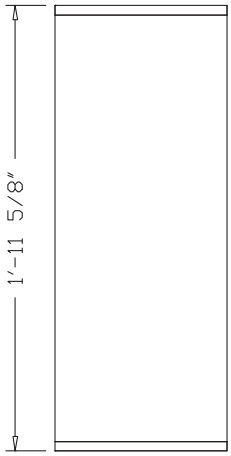
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

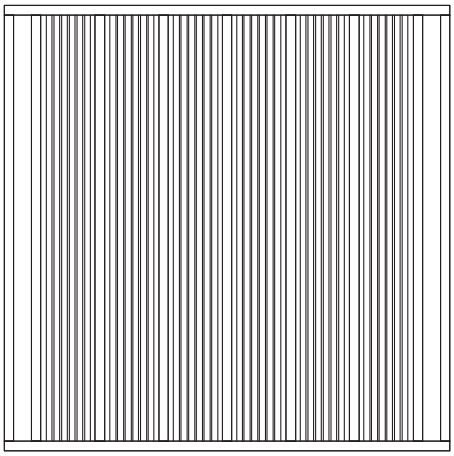
Diffractal®



2' x 2' EE Cutsheet







Project:

Specifier:

Drawing Number:

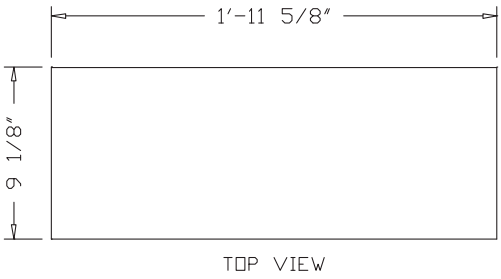
Date:

Tolerance: ± 1/16"

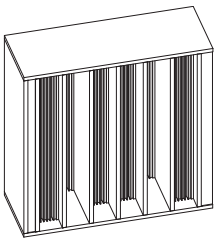
*The **Sound** of **Innovation***

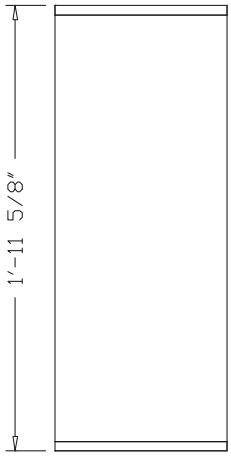
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

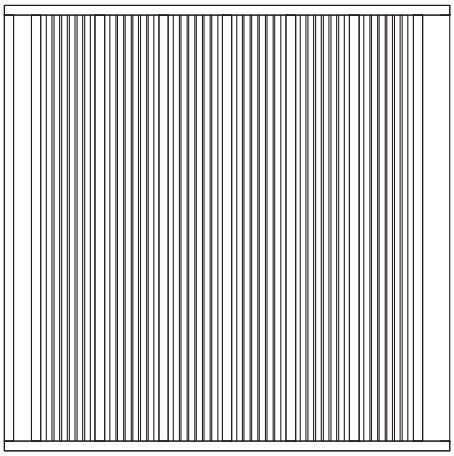
Diffractal®



2' x 2' EH Cutsheet







Project:

Specifier:

Drawing Number:

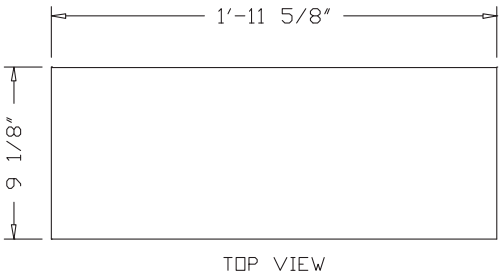
Date:

Tolerance: ± 1/16"

*The **Sound** of **Innovation***

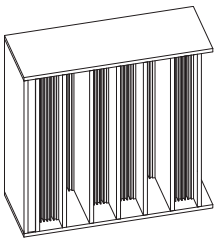
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

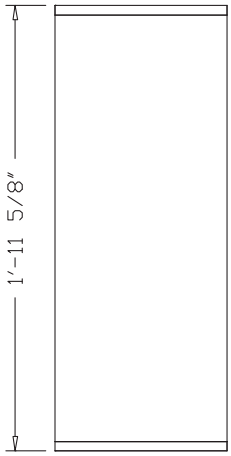
Diffractal®



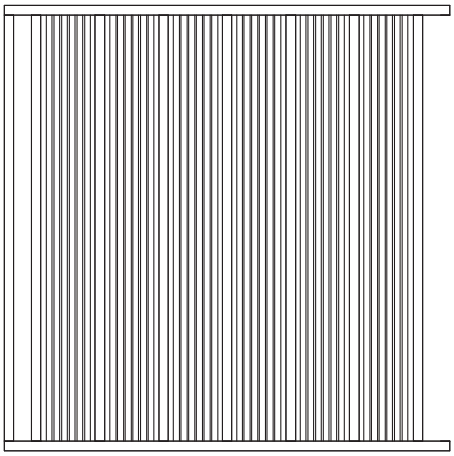
TOP VIEW

2' x 2' EJ Cutsheet





LEFT SIDE



FRONT VIEW

Project:

Specifier:

Drawing Number:

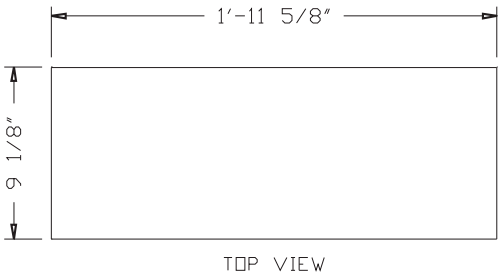
Date:

Tolerance: ± 1/16"

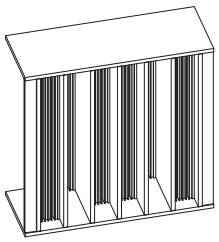
*The **Sound** of **Innovation***

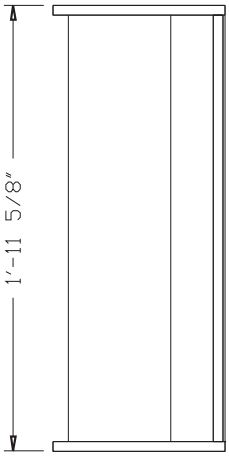
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

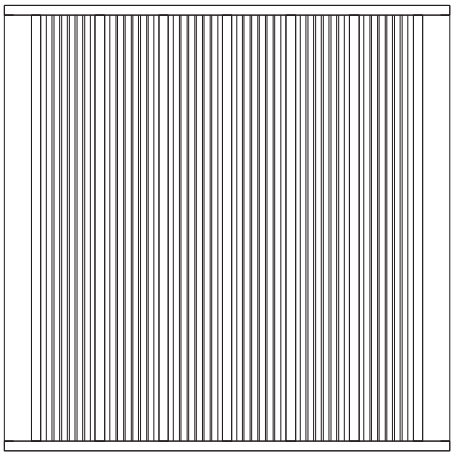
Diffractal®



2' x 2' HH Cutsheet







Project:

Specifier:

Drawing Number:

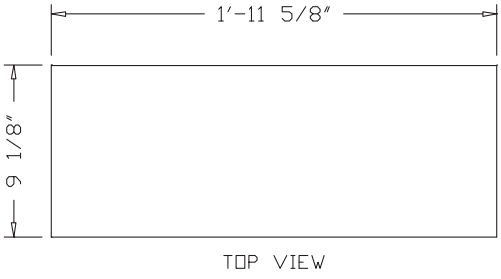
Date:

Tolerance: ± 1/16"

*The **Sound** of **Innovation***

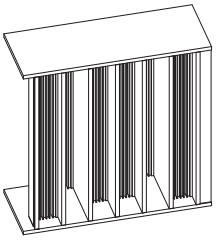
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

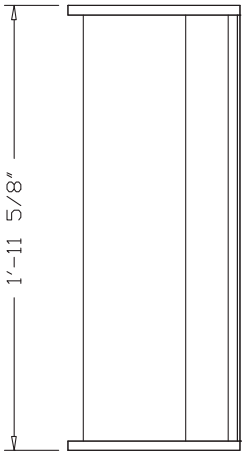
Diffractal®



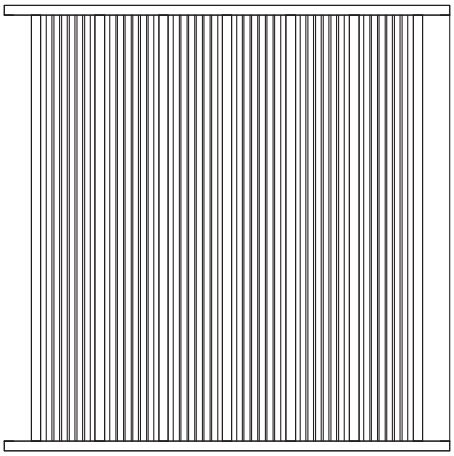
TOP VIEW

2' x 2' HJ Cutsheet





LEFT SIDE



FRONT VIEW

Project:

Specifier:

Drawing Number:

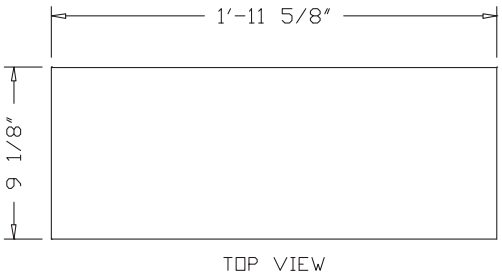
Date:

Tolerance: ± 1/16"

*The **Sound** of **Innovation***

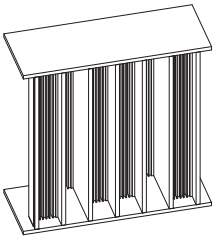
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

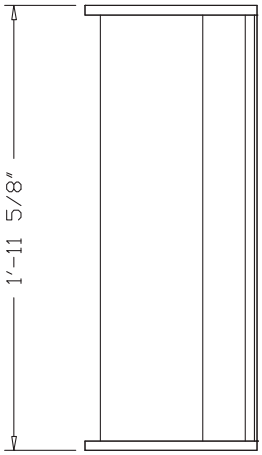
Diffractal®



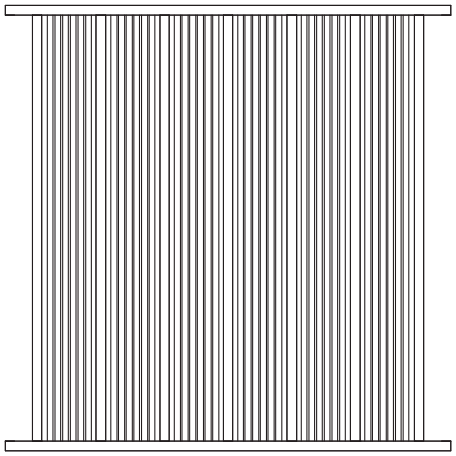
TOP VIEW

2' x 2' JJ Cutsheet





LEFT SIDE



FRONT VIEW

Project:

Specifier:

Drawing Number:

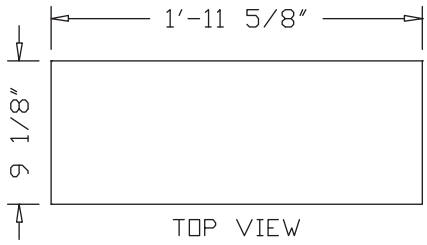
Date:

Tolerance: ± 1/16"

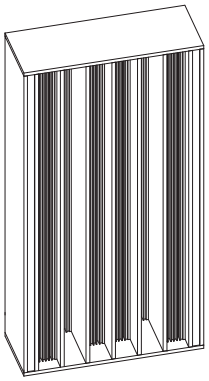
*The **Sound** of **Innovation***

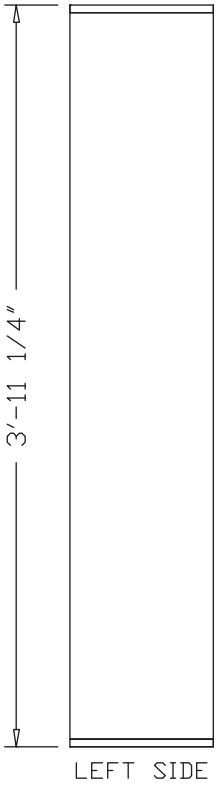
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

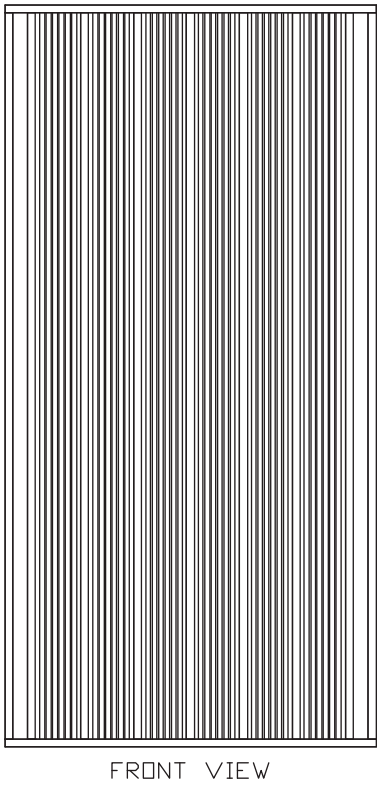
Diffractal®



4' x 2' EE Cutsheet







Project:

Specifier:

Drawing Number:

Date:

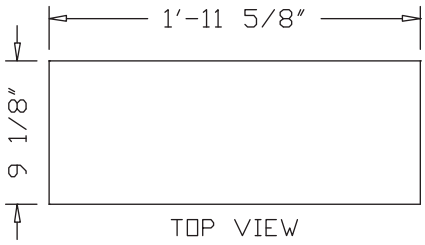
Tolerance: ± 1/16"

RPG®

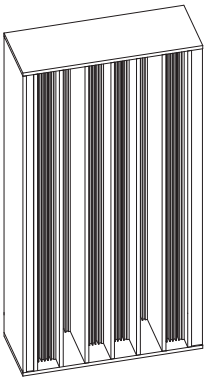
*The **Sound** of **Innovation***

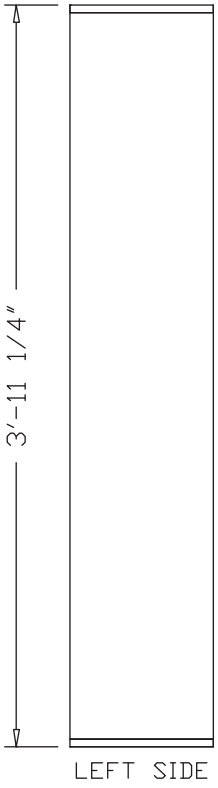
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

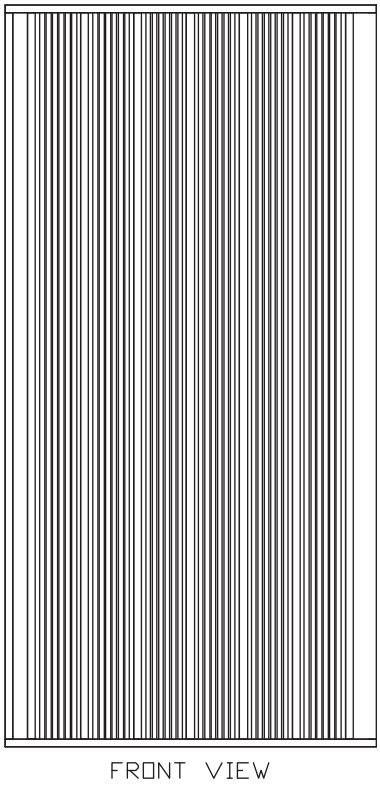
Diffractal®



4' x 2' EH Cutsheet







Project:

Specifier:

Drawing Number:

Date:

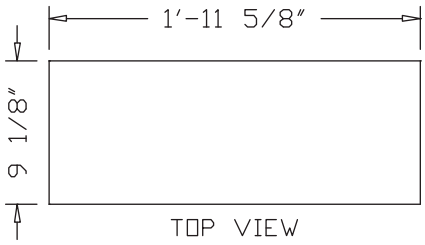
Tolerance: ± 1/16"

RPG®

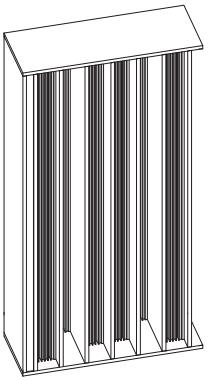
*The **Sound** of **Innovation***

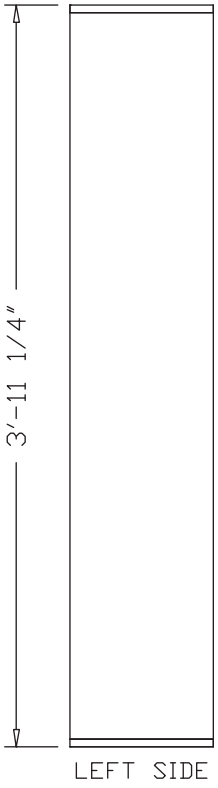
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

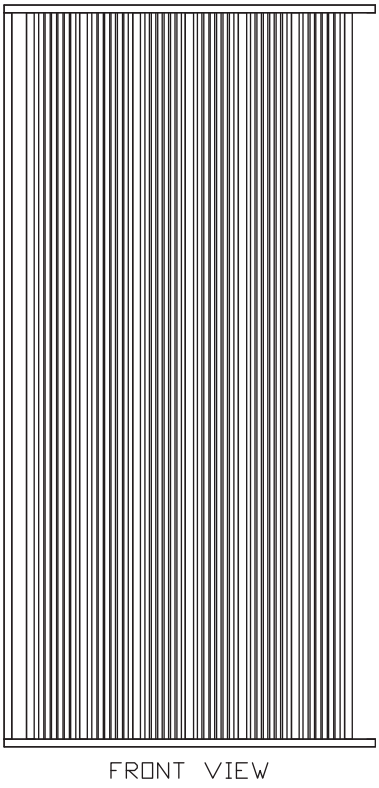
Diffractal®



4' x 2' EJ Cutsheet







Project:

Specifier:

Drawing Number:

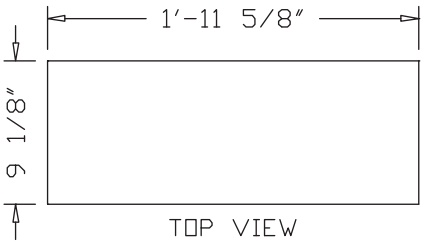
Date:

Tolerance: ± 1/16"

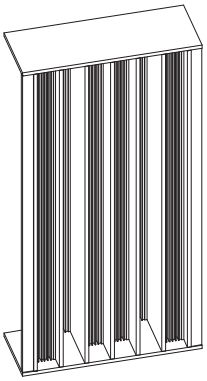
*The **Sound** of **Innovation***

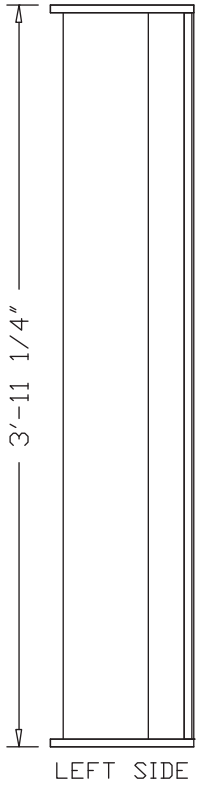
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

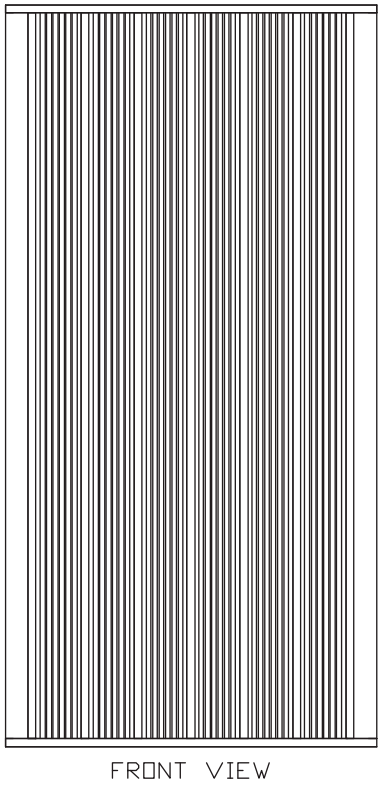
Diffractal®



4' x 2' HH Cutsheet







Project:

Specifier:

Drawing Number:

Date:

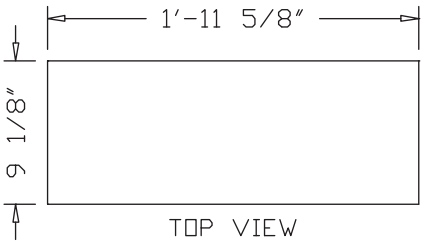
Tolerance: ± 1/16"

RPG®

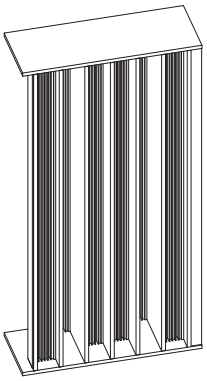
*The **Sound** of **Innovation***

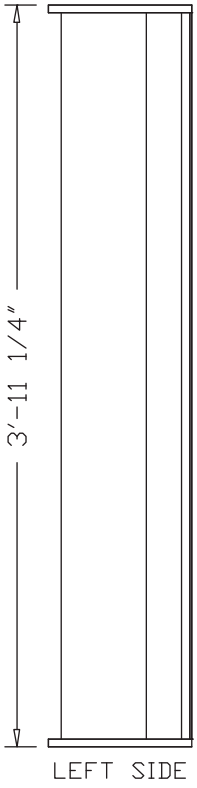
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

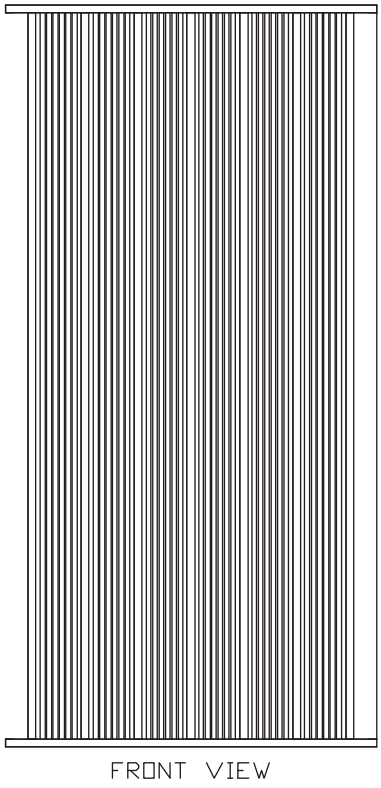
Diffractal®



4' x 2' HJ Cutsheet







Project:

Specifier:

Drawing Number:

Date:

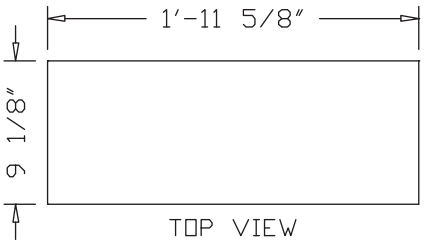
Tolerance: ± 1/16"

RPG®

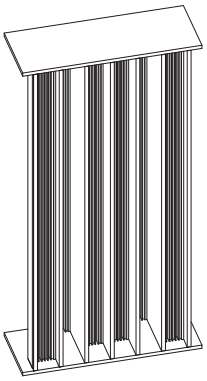
*The **Sound** of **Innovation***

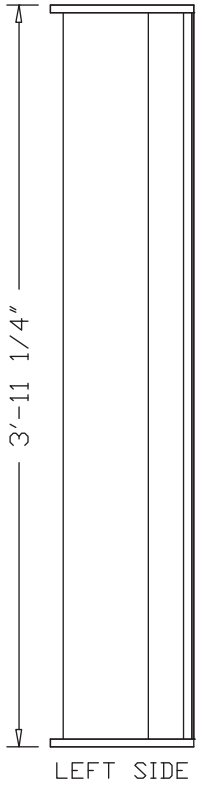
651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

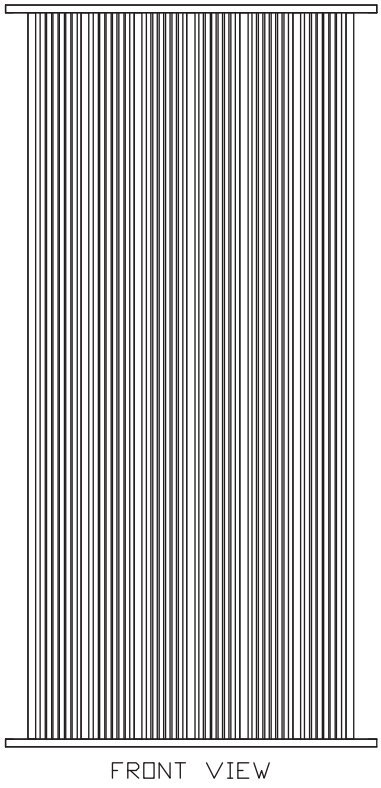
Diffractal®



4' x 2' JJ Cutsheet







Project:

Specifier:

Drawing Number:

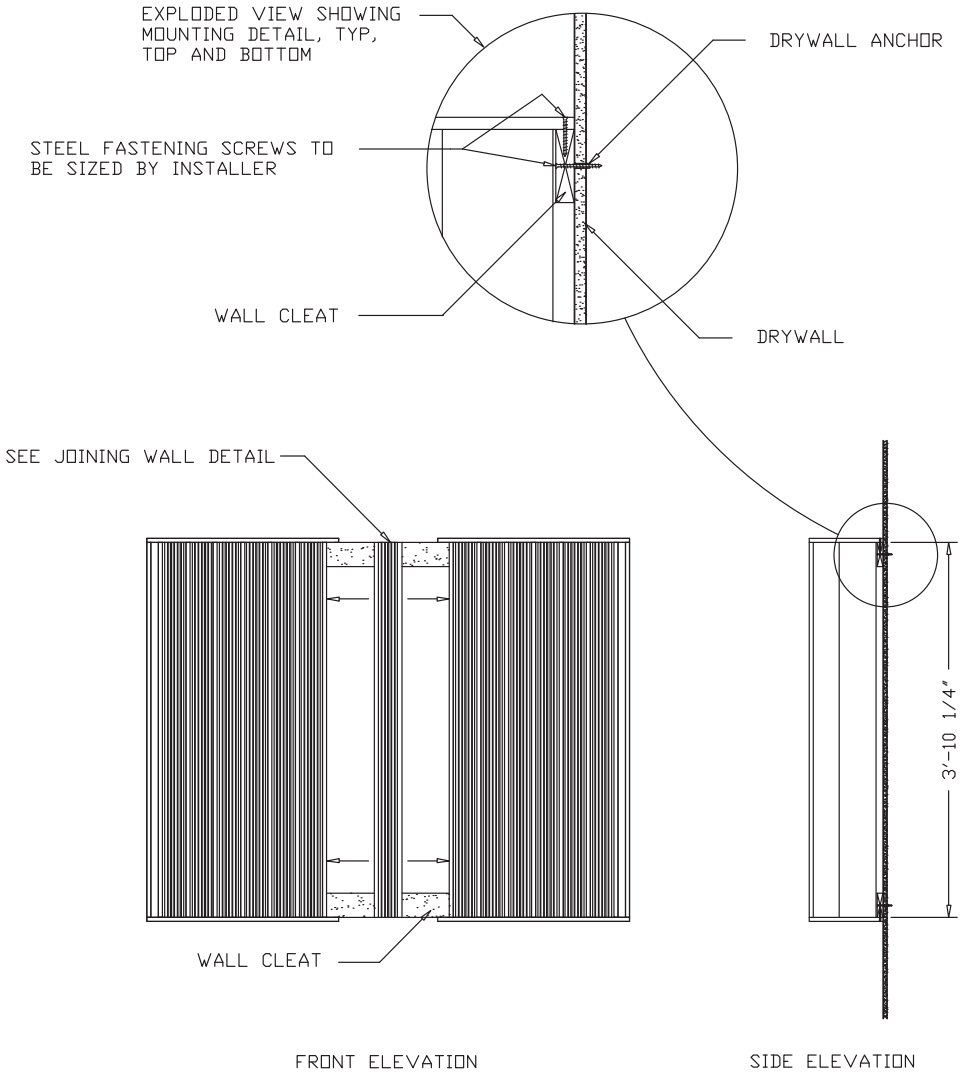
Date:

Tolerance: ± 1/16"

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Diffractal®



Surface Mount

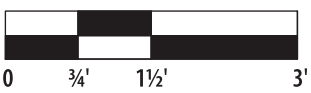
Project:

Specifier:

Drawing Number:

Date:

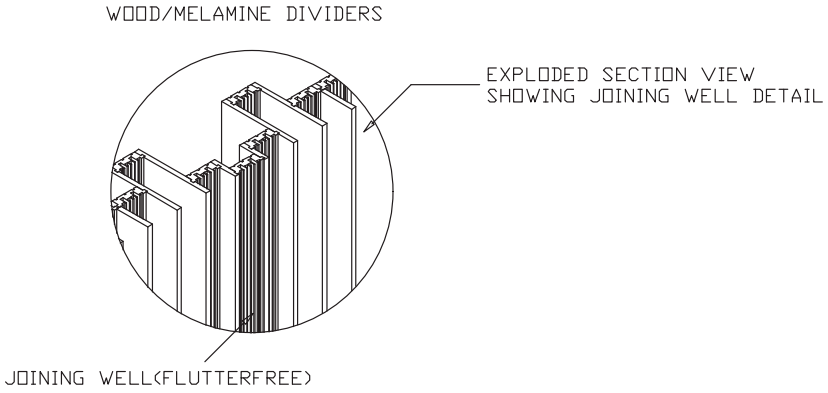
All dimensions should be field verified prior to installation.



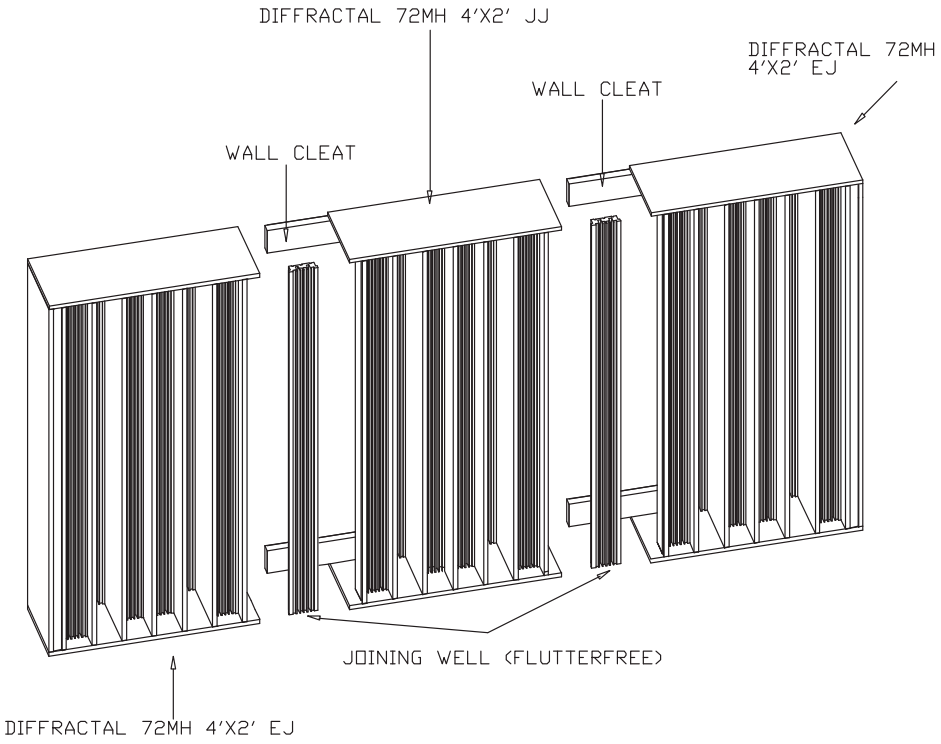
*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Diffractal®



Joining Well Mount



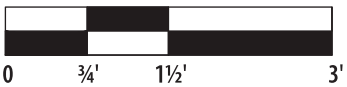
Project:

Specifier:

Drawing Number:

Date:

All dimensions should be field verified prior to installation.



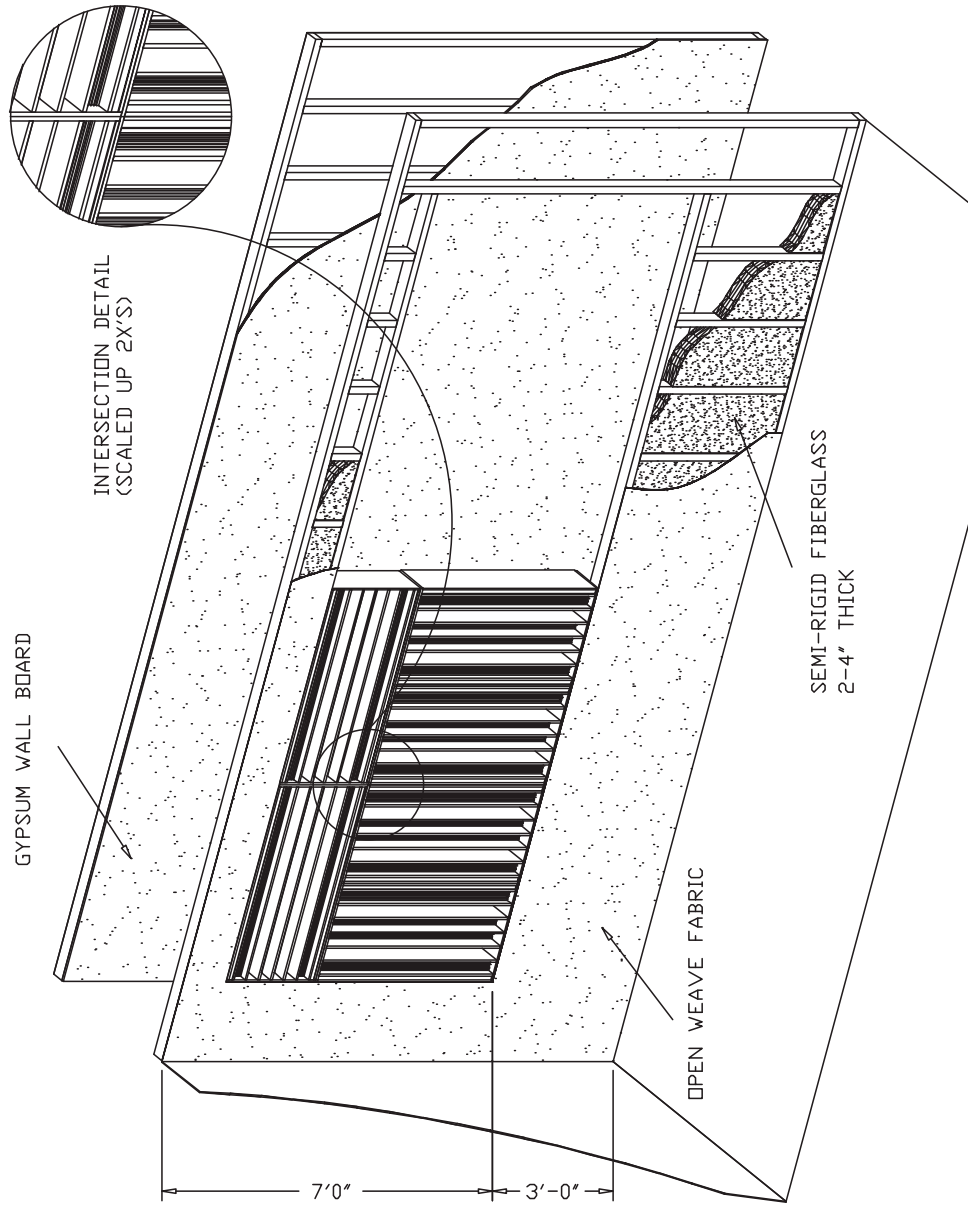
RPG®

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Diffractal®

4' x 2' Flush Mount



Project:

Specifier:

Drawing Number:

Date:

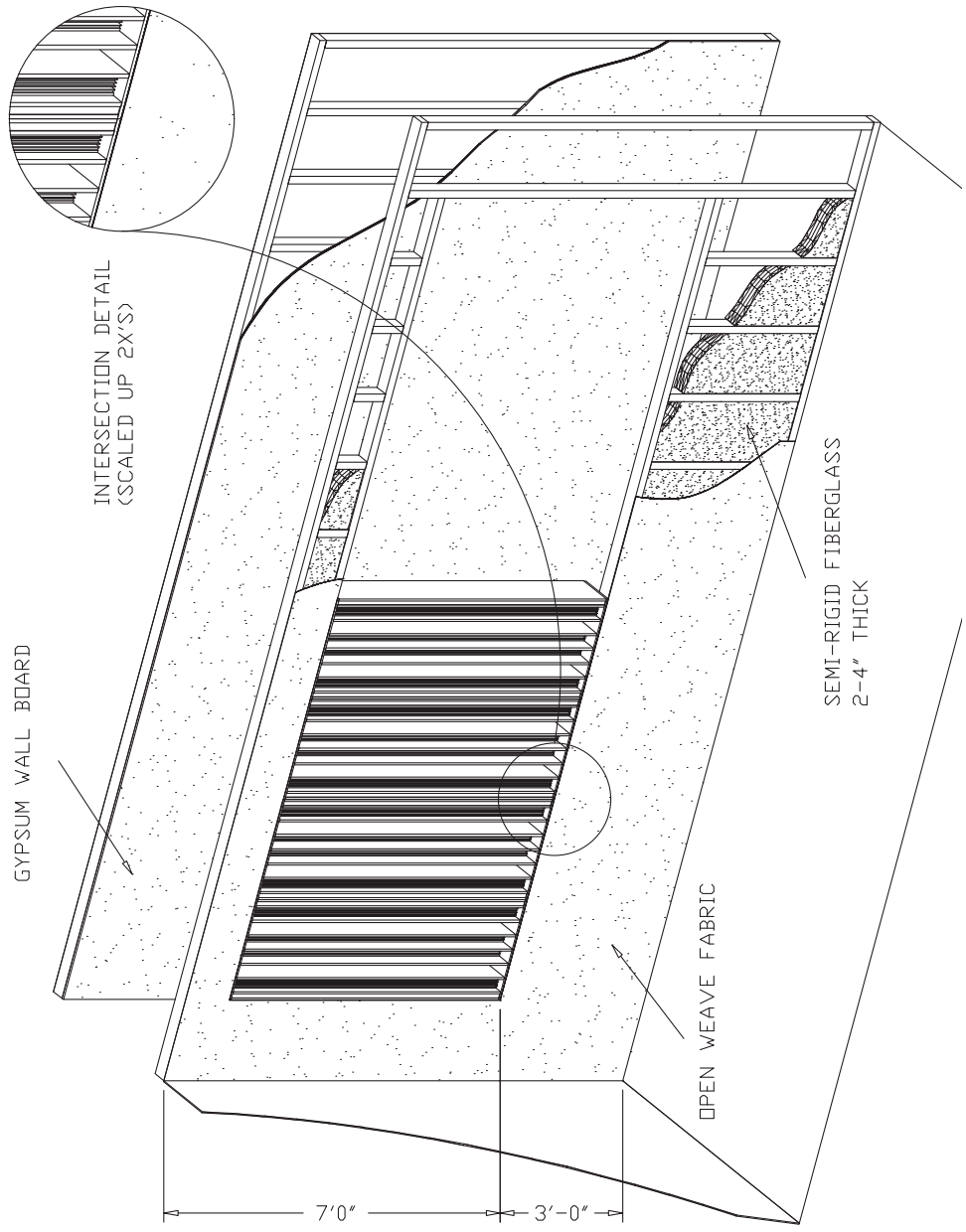
All dimensions should be field verified prior to installation.

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Diffractal®

Custom Height Flush Mount



Project:

Specifier:

Drawing Number:

Date:

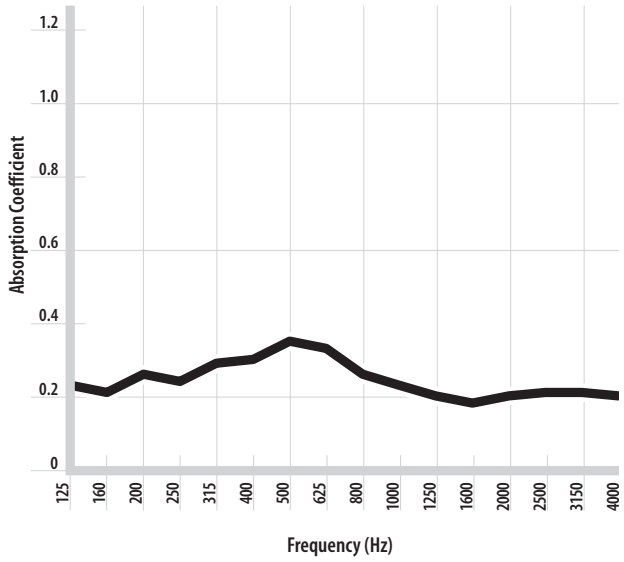
All dimensions should be field verified prior to installation.

RPG®

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Absorption Coefficients



Hz	Absorption Coefficient
125	0.23
160	0.21
200	0.26
250	0.24
315	0.29
400	0.30
500	0.35
625	0.33
800	0.26
1000	0.23
1250	0.20
1600	0.18
2000	0.20
2500	0.21
3150	0.21
4000	0.20

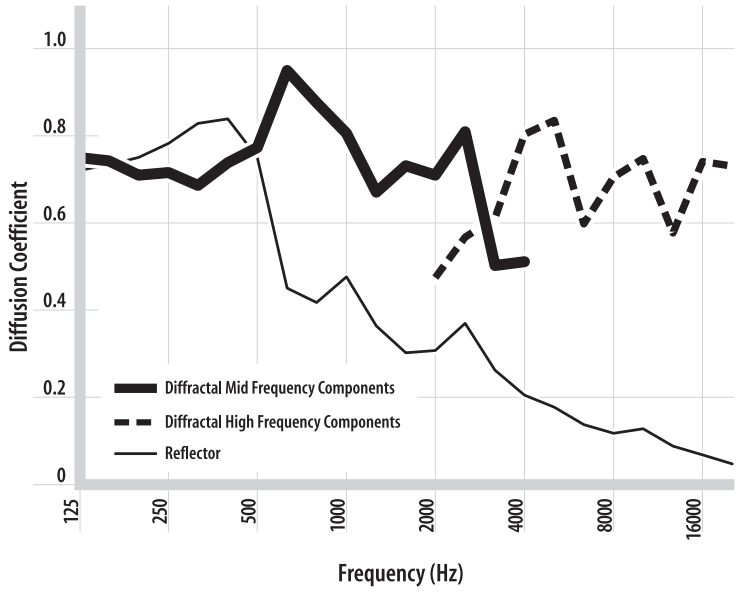
RPG®

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com

Diffractal®

Diffusion Coefficients



Hz	Diffractal® Mid Frequency Components	Diffractal® High Frequency Components	Reflector
125	0.75		0.72
160	0.74		0.73
200	0.71		0.75
250	0.71		0.78
315	0.68		0.83
400	0.74		0.84
500	0.77		0.75
630	0.95		0.45
800	0.87		0.42
1000	0.80		0.47
1250	0.67		0.36
1600	0.73		0.30
2000	0.71	0.47	0.30
2500	0.81	0.57	0.37
3150	0.50	0.61	0.26
4000	0.51	0.80	0.20
5000		0.83	0.18
6300		0.60	0.14
8000		0.70	0.12
10000		0.75	0.13
12500		0.58	0.09
16000		0.74	0.07

RPG®

*The **Sound** of **Innovation***

651-C Commerce Drive, Upper Marlboro, MD, 20774, Phone: 301.249.0044, Fax: 301.249.3912, Email: info@rpginc.com, Internet: www.rpginc.com