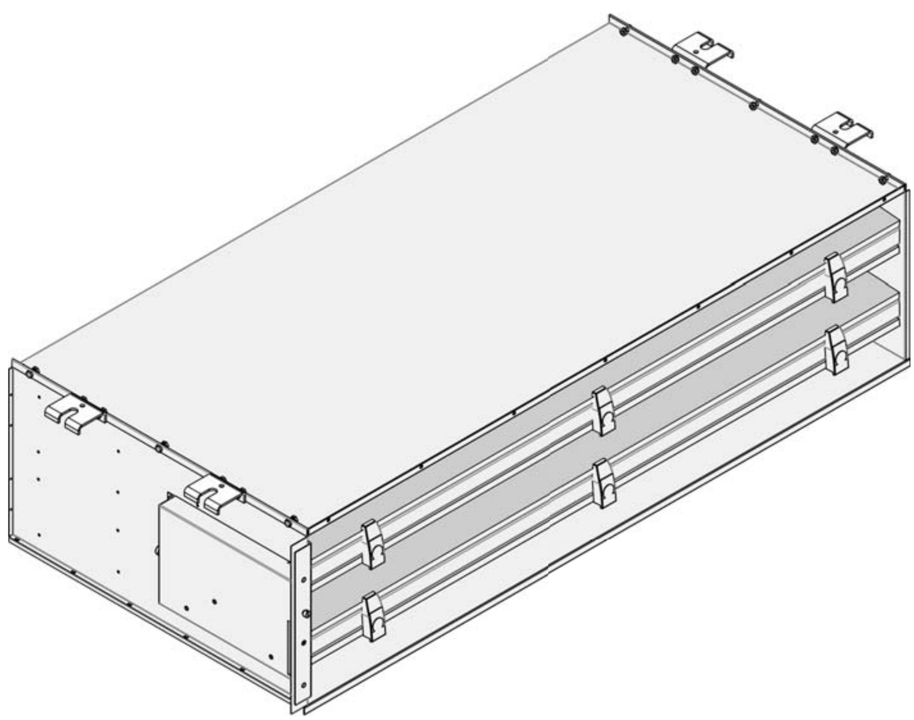
DYNAMIC V8® VL SERIES AIR CLEANER ENGINEERING MANUAL



For LG High Static Ducted Indoor Units

LG
Life's Good

Patents, Trademarks, and Proprietary Data

Content Updates

Information in this document is subject to change without notice. Due to continual product development, LG Electronics and Dynamic Air Quality Solutions reserve the right to change specifications without notice. Please visit our website at www.lg-vrf.com to ensure that you have the latest version.

LG

Life's Good

Table of Contents

Introduction

Company Overview

LG Electronics

Overview

LG Electronics is a global leader and technology innovator in consumer electronics, mobile communications, and home appliances, employing over 213,000 people in over 115 operations worldwide. LG comprises four business units - Home Entertainment, Mobile Communications, Home Appliance, and Air Conditioning and Energy Solutions. LG is one of the world's leading producers of flat panel televisions, audio and video products, mobile handsets, air conditioners, and washing machines. LG's commercial air conditioning (CAC) business unit was established in 1968 and has built its lineup of residential and commercial products to include VRF, Multi F, duct free split systems, PTACs, and room air conditioners. In 2011, the air conditioning and energy solutions business unit grew to include LED lighting and solar products. For more information, visit www.lghvac.com.

Commitment to Innovation

LG Commercial Air-Conditioning is committed to providing a full line of products that employs state of the art technology and innovation, such as our award winning ArtCool picture frame, duct-free split system, and Multi V family of air and water cooled VRF heat pumps.

As part of our commitment to bringing innovation to the markets we serve, LG actively seeks partnerships with other innovation leaders. For air cleaning, we are excited to offer the technology developed and patented by Dynamic Air Quality Solutions. We introduce the Dynamic V8® VL Series of air cleaning products specifically designed to work in harmony with LG Multi V III, Multi V Water, and Multi V Mini VRF high-static-ducted indoor units.

Dynamic Air Quality Solutions

In 1982, two university professors from Carleton University in Ontario, Canada developed a design for a residential air-cleaning application that provided a simple means of replacing dirty media. They started Engineering Dynamics, Ltd. (EDL) and began manufacturing 1” and 2” polarized-media electronic air cleaners, room console units, and overhead ceiling-mount units. All of the polarized-media air cleaners on the market today can be traced back to beginnings at EDL, although subsequent patents and refinements have created discernible differences in product designs and features.

EDL was acquired in 1993 by Environmental Dynamics Group, now known as Dynamic Air Quality Solutions, the manufacturer of Dynamic Air Cleaners. Initially the focus was residential, but there was a clear need for improved air quality in commercial and industrial applications. This resulted in a focus on technology enhancements, new configurations, and a complete line of commercial products that now dominate in some applications, such as casinos.

Although there were a number of different configurations that came before the Dynamic V8, all were based on polarizing (charging) fibers in a filter and particles in the air to generate an electric force between those fibers and particles. While the underlying principles have been around for many decades, only in recent years has the technology been fully understood and optimized to provide consistent, reliable performance.

As a result of this research and development, we proudly present the Dynamic V8 Air Cleaner. As the standard in air cleaning, the Dynamic V8 VL Series delivers maximum performance with minimal air pressure drop over the life of the media.

Architectural Appeal

Benefits

- High ceilings
- Shallow plenums
- Local or remote mount
- Minimal environmental impact
- Energy savings
- Operational savings

Removes

- Ultra-fine particulate
- Gas-phase contaminates
- Biological contaminants
- Odors

All-in-One Solution

Designed to meet the rigorous requirements of data centers, hospitals, pharmaceutical and clean manufacturing, which typically require HEPA or carbon filter technology, the Dynamic V8 air cleaning system performs at nearly the same level.

Beyond MERV 13, the Dynamic V8 air cleaners substantially reduce dangerous airborne biological contaminants, ultra-fine particulate, VOCs, and odors without the use of ionizers and ozonators.

Simply the Best Value!

Real air cleaning that delivers real savings. The least expensive filter is the one that you rarely replace. Media change intervals measured in years instead of months drives down purchasing department overhead expense. Fewer maintenance routines significantly lowers media-maintenance-related labor costs.

Green Design and LEED®

Whether you are seeking LEED certification or simply designing with green principles in mind, the Dynamic V8 air cleaning media is completely consistent with the goals of LEED and Green Design—it does more with less—more IAQ, less energy, less time, and less waste. It is the choice for LEED projects where clean air is truly important.

Dynamic V8 Track Record

Dynamic V8 air cleaners have proven successful at removing VOCs and odors using active-field polarization and particle agglomeration.

This patented technology has been commercially available for years in a heavy duty stackable frame arrangement.

With over 300 completed projects and many satisfied customers, you should make this product the basis of specification.

In a highly urban environment, the Dynamic V8 Air Cleaning media provides indoor air with levels of ultra-fine particles and black carbon from vehicle exhaust that are over 90% better than outdoor air levels.

In testing performed on an office building equipped with Dynamic V8 air cleaning systems in downtown Washington, D.C., ultrafine particle levels were 92-99% lower than in the outdoor air.

At the ASHRAE Headquarters building in Atlanta, GA, where the Dynamic V8 media was installed over 4 years ago, tests indicated that filter media will likely be in service another 2 years before the first maintenance interval occurs.

For other case studies, go to www.DynamicAQS.com. Click the Engineers and Architects tab and then Case Studies in the left-hand column.

Engineer's Advantage

Engineered for VRF Systems

Dynamic V8 VL Series Air Cleaners provide one IAQ Solution that addresses all three types of airborne contaminants:

- Large, Small, and Ultra Fine Particulate
- Odors and VOCs
- Biological Contaminants

Because of its low pressure drop and flat loading curve, the Dynamic V8 is the ideal air cleaner choice to use with VRF systems.

The media and air cleaner chassis are constructed to eliminate bypass air—a critical issue for maximum performance. The Dynamic V8 outperforms anything in the market.

Features

- Fully compatible with all LG high-static-ducted indoor units.
- Lightweight design: Air cleaners weight less than 53 pounds or less.
- Two configurations: a low-profile 4VL model and an ultra-low-profile 2VL model.
- Two return-air grille designs: egg-crate or louvered.
- Silent operation adds to potential installation locations.

Benefits

- Simplifies ASHRAE Standard 62.1-2010 ventilation air calculations using the IAQ method.
- Potential for significantly downsizing dedicated outdoor-air systems.
- Flat loading curve—very low static pressure drop over the life of the media.
- Reduces airborne sub-micron-sized particulate.
- Reduces the level of airborne biological contaminants.
- Reduces reactive gas-phase contaminants, such as volatile organic compounds (VOCs).

Low Ownership Cost

- Maintenance cycles measured in years instead of months.
- Placed in identical environments, the Dynamic V8 media will need to be changed once for every 67 times a typical 2” MERV 13 throwaway filter is changed.
- One media-pad size fits all air cleaners.
- Easy maintenance access via the optional return-air plenum.
- Minimizes filter-related disposal costs.
- Smaller environmental footprint.

Air Cleaning for All Environments

- Outstanding single pass filtration performance: MERV 13 @ 1968 CFM without the media polarized and MERV-NC rating of 15 @ 1968 CFM with media polarized.
- To put the MERV-NC rating in perspective, the Dynamic V8 captured a minimum of 95% of the 0.3 micron ultra fine particulate on a single pass. To be rated as a HEPA filter, it must capture 97.7% of 0.3 micron particulate on a single pass. Thus, the Dynamic V8 offers near-HEPA filtration at a fraction of the air pressure drop.

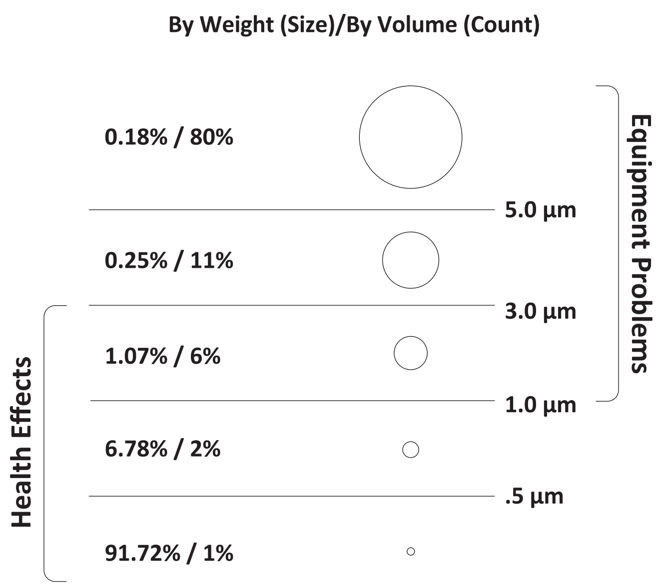
Air Quality

DAQS air cleaners protect much more than just the HVAC equipment. Our lungs and respiratory systems, as well as very sensitive electronics, are more susceptible to problems arising from the sub-micron, ultrafine particles. Those particles bypass your body's defenses and can carry with them a wide variety of VOC's and reactive gas phase contaminants.

The most dangerous and troublesome particles are the smallest ones.

In any given space, the number and weight of contaminating particles are inversely related: A few big particles make up the bulk of the mass, while the millions of ultra-fine particles—which cause the most health problems—make up the bulk of the particle count but a tiny fraction of the mass. Coils and equipment are prone to damage from larger particles, and historically filters were designed to preserve equipment performance.

Figure 1: Particle count and mass distribution.



The mainstream filter industry for the most part has ignored gas-phase contaminants. Traditionally, the only economical solution was to ventilate the building, sometimes in excess, to minimize the gas-phase contaminate level; however, with the air cleaning technology and value provided by the Dynamic V8, building owners now have the option of minimizing the outside air brought into the building and use a Dynamic V8 Air Cleaner to control the gas-phase and biological contaminates.

Indoor gas phase contaminant sources include:

- Cleaning chemicals
- Furnishings off-gassing
- Paints and finishes
- Residue from smoke
- Adhesives
- Body odors
- Urine
- Human waste
- Pet odors

Often, poor outdoor air quality results in indoor air quality problems. Especially in urban areas, outside air typically is contaminated with ultra-fine particles (UFPs), odors, exhaust fumes, or a combination thereof. Outdoor gas-phase contaminant sources include:

- Vehicle Emissions
- Diesel Exhaust
- Jet Engine Exhaust
- Tobacco Smoke
- Fine Dust
- Mold Spores
- Bacteria
- Viruses
- Black carbon (soot)

Use Dynamic V8 VL Series products to clean the building ventilation air at the Dedicated Outdoor Air System (DOAS) equipment.

How Does It Work?

The Dynamic V8 delivers MERV 13–15 performance without using ionizing technology or generating ozone.

The Dynamic V8 uses patented developments in active-field technology to polarize both media fibers and airborne particles. Its polarized particles absorb gas phase contaminants and are drawn to both the fibers of the media and other particles, resulting in deeply cleaned air.

Another inherent mechanism of polarization is particle agglomeration where ultrafine particles become polarized after passing through the air cleaner and thus are attracted to each other and other chemical contaminants, forming bigger particles that are subsequently captured.

This mechanism gives the Dynamic V8 air cleaner its ability to capture a higher percentage of airborne ultrafine particles. Loading is the most critical characteristic to understand when deciphering the most cost-effective filtration solution.

Superior Dust Holding Capacity

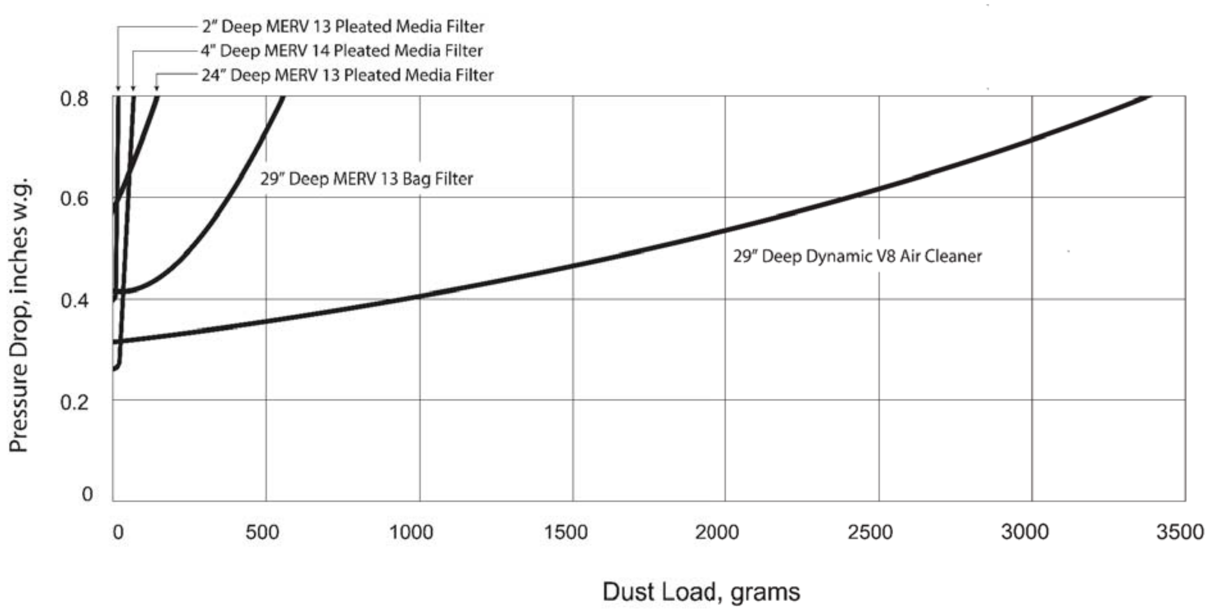
In order to determine the true value of air cleaning media, one must understand the dust holding capacity. The higher the dust holding capacity at the maximum static pressure capability of the indoor unit fan, the more money you will save over the life of the building by extending the time between media changes from 1 - 3 months to multiple years.

By design, passive air cleaning media becomes more effective as it becomes more loaded because the captured particulate builds up on the windward surface of the media. As it accumulates, it fills the gaps between the media fibers, and captured particulate itself assists in the capture of still more particulate.

The drawback of using passive throw-away filter media has always been their short lifespan and the continuous labor and maintenance required to change them. As the captured particulate loads on the face of the media, the filter becomes more efficient, but the air pressure drop across the media rises rapidly over a short period of time. This is known as a "steep loading curve." This phenomenon increases the static pressure the fan must overcome, raising the indoor unit's energy consumption and forcing frequent filter changes to prevent the cooling/heating equipment from malfunctioning.

DAQS had an independent lab test various types of passive filter media as well as the Dynamic V8 using the single pass ASHRAE Standard 52.2 test protocol. The test used SAE Standard J726 test dust (fine) to best simulate

Figure 2: Air filter pressure drops with increasing dust loads.



real-world conditions. Refer to Figure 2 on page 6.

The air pressure drop was compared to the weight of SAE fine test dust captured. Notice the loading characteristics of the MERV-13-rated pleated filter and the MERV-14-rated 4” pleated filter. The dust holding capacity tops out between 50 and 75 grams with the air pressure drop at 0.80 in-wg. Compare that with the Dynamic V8 media’s flat loading curve, and note the following:

- The media captured 3350 grams of particulate at 0.8 in-wg.
- The media captured 6,700% more dust by weight than the MERV 13 rated 2” throw-away media.
- The media holds up to 100 times the dust of traditional 2” pleated media passive filters.
- The obvious value choice is the Dynamic V8.

Unit Nomenclature

Z	FBX	D4	01	A

Family
Z = Accessory

Type
FBX = Filter Box
PLM = Plenum
GRL = Grille

Primary Descriptor
D4 = Dynamic 4-Panel Chassis
D2 = Dynamic 2-Panel Chassis
RA = Return Air
V2 = Dynamic 2VL
V4 = Dynamic 4VL

Design Number
01 - 99

Product Revision
A - Z

System Engineering

General Data

Table 1: General Data — Air Cleaner

Characteristic	Dynamic V8 4VL (ZFBXD402A)	Dynamic V8 2VL (ZFBXD201A)
Physical Characteristics		
Height Profile	Standard Profile	Low Profile
Case Height	12-1/8"	7-1/8"
Case Dimensions (L × W)	22-1/4" × 46"	22-1/4" × 46"
Outlet Connection, Standard/Optional	Flush Surface/ Flange[1]	Flush Surface/ Flange[1]
Return Air Connection	Flush Surface	Flush Surface
Case material	24-gauge G90 galvanized steel	24-gauge G90 galvanized steel
Insulation	Field Provided	Field Provided
Operating Weight	43 lbs	53 lbs
Media Characteristics		
Quantity of pads	4	2
Type	Throwaway	Throwaway
Pad Dimensions (L × W × D)	44" × 20-3/4" × 1.0"	44" × 20-3/4" × 1.0"
Pad Free Area Dimensions (L × W)	41-1/8" × 18-3/4"	41-1/8" × 18-3/4"
Media Total Free Area (ft^2)	21.42	10.71
Media factory mounted	Yes	Yes
Arrangement	Double V, Horizontal	Single V, Horizontal
Active Field	Yes	Yes
Technology	Passive Polarized	Passive Polarized
Patent Status	See note 3	See note 3
Material	Polyolefin	Polyolefin
Pad Layer Count	3	3
Loading Characteristics	360° Non Face Loading	360° Non Face Loading
Life Expectancy[2]	4 Years	4 Years
Flame/Smoke Rating	UL 900 Class 2	UL 900 Class 2
Electrical Characteristics		
Power Consumption (Watts)	144	72
Control Voltage	24 VAC	24 VAC
Filter Control Box Connection	30' wire with quick-connect plug[5]	30' wire with quick-connect plug[5]
Power requirement	208/60/1	208/60/1
Air Cleaner Power Transformer[4]	208 to 24 VAC	208 to 24 VAC

1 Discharge flange included with air cleaner — optional field mounted
2 Based on performance of live lab installation at ASHRAE Headquarters Building in Atlanta, Georgia. Your results may vary.
3 U.S. and foreign patents 7,686,869; 8,070,861; 7,708,813; 7,691,186; Others allowed and pending.
4 Control power transformer ships with the air cleaner.
5 Quick connect plug to air cleaner control box.

Configurations

Dynamic V8 VL-series air cleaners can be configured in numerous ways, depending on the high-static-ducted indoor unit chosen and the height of the plenum. There are five standard-profile configurations, eight- low-profile configurations, and two mixed-profile configurations. Configurations may share the same plan (top) view because they differ only in height. For example, the L1R1 and S1R1 configurations are the same and only differ in the height of the air cleaners and plenums involved; when diagramed from above, they look the same.

Configuration Code

Each configuration is defined by three qualities:

- Which air cleaner type or types it uses
- How many of each air cleaner type it uses
- How many return air plenums it requires

Therefore, the code for each configuration is in the form:

L<count>R<count> or S<count>R<count>

Where:

S = standard profile (4VL)

L = low profile (2VL)

R = return-air plenum

<count> = quantity

Configuration Code Examples

For example, S3R3 means three standard profile (4VL) air cleaners coupled to three return-air plenums, and L1R1 means one low profile (2VL) air cleaner coupled to one return-air plenum.

Some profiles have both standard profile and low profile air cleaners, so their code is slightly longer. For example, L1S1R2 means one low profile (2VL) and one standard profile (4VL) air-cleaner coupled with two return-air plenums.

Table 2: Air Cleaner Configuration and Indoor Unit Models

Code	Description	ARNU073BHA2	ARNU093BHA2	ARNU123BHA2	ARNU153BGA2	ARNU153BHA2	ARNU183BGA2	ARNU183BHA2	ARNU243BGA2	ARNU243BHA2	ARNU283BGA2	ARNU363BGA2	ARNU423BGA2	ARNU483BRA2	ARNU543BRA2	ARNU763B8A2	ARNU963B8A2
Standard-Profile (4VL) Configurations																	
S1R1	One 4VL air cleaners, one return-air plenum	•	•	•	•	•	•	•	•	•	•						
S2R1	Two 4VL air cleaners, one return-air plenum											•		•	•	•	•
S2R2	Two 4VL air cleaners, two return-air plenums											•		•	•	•	•
S3R2	Three 4VL air cleaners, two return-air plenums												•				
S3R3	Three 4VL air cleaners, three return-air plenums												•				
Low-Profile (2VL) Configurations																	
L1R1	One 2VL air cleaner, one return-air plenum	•	•	•	•	•	•		•								
L2R1	Two 2VL air cleaners, one return-air plenum							•		•	•						
L2R2	Two 2VL air cleaners, two return-air plenums							•		•	•						
L3R2	Three 2VL air cleaners, two return-air plenums											•		•	•		•
L3R3	Three 2VL air cleaners, three return-air plenums											•		•	•		•
L4R2	Four 2VL air cleaners, two return-air plenums															•	
L4R4	Four 2VL air cleaners, four return-air plenums															•	
L5R3	Five 2VL air cleaners, three return-air plenums												•				
Mixed-Profile (2VL/4VL) Configurations																	
L1S1R1	One 2VL air cleaner, one 4VL air cleaner, one return-air plenum											•		•	•	•	•
L1S1R2	One 2VL air cleaner, one 4VL air cleaner, two return-air plenums											•		•	•	•	•

Selecting a Configuration

To select a configuration, you must know the indoor unit model number in question and the height of the plenum area you intend to install it in. The underlying property that dictates which configurations are available to an indoor unit model is that model's air flow requirements. The configurations available may or may not be dictated by the available plenum area height.

Plenum-Area Height Restrictions

Plenum area height restrictions are not defined in the configuration type (S1R1, L2R2, and others); however, which configuration you choose may be dictated by the plenum area you have available. For example, while perhaps not optimal, you can put a low-profile configuration in any plenum area height you desire, but if you have a plenum area with a severely constricted height, you might have to use a low-profile configuration.

Figure 3: Elevation view of a typical S1R1 installation.

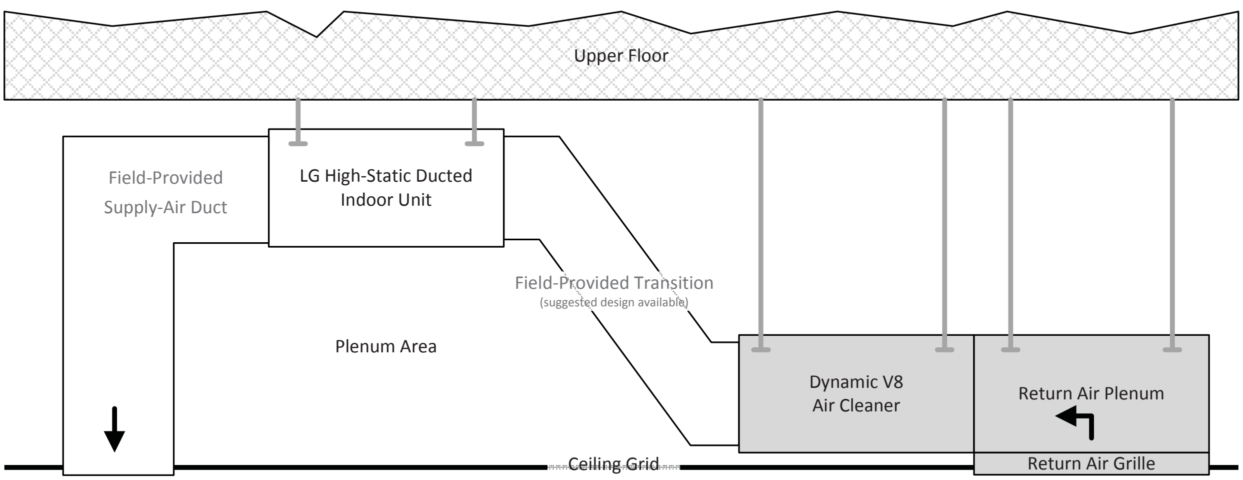


Figure 4: Elevation view of a typical L1R1 installation.

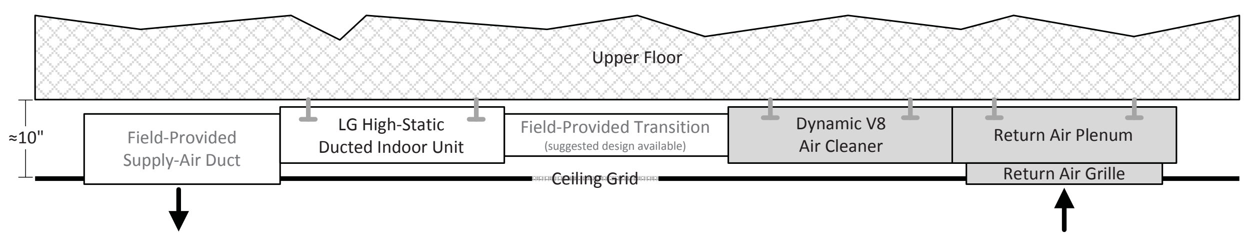
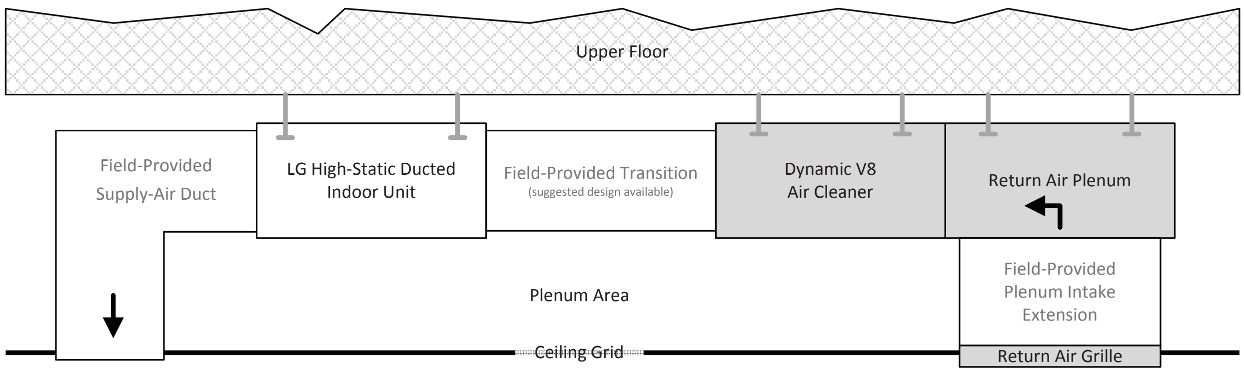


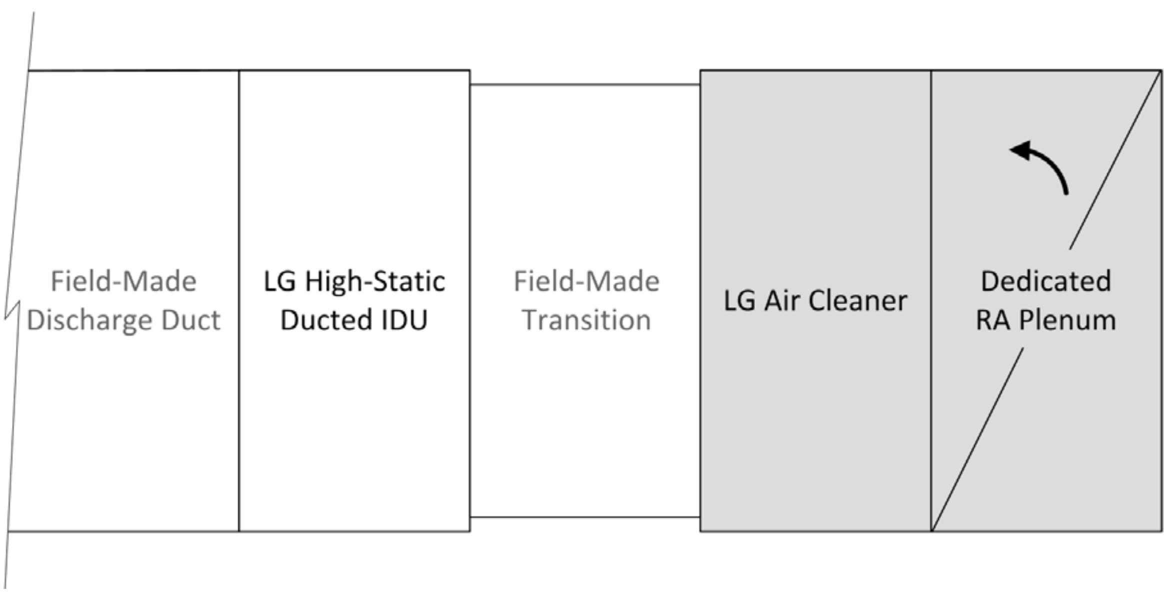
Figure 5: Elevation view of S1R1 with field-provided plenum intake extension.



Configurations S1R1 and L1R1

The simplest configurations have one Dynamic V8 Air cleaner and one return air plenum as shown in Figure 6 on page 14. These configurations only differ in whether the engineer decides to use a standard- or low-profile air cleaner, return-air plenum, and supporting ductwork.

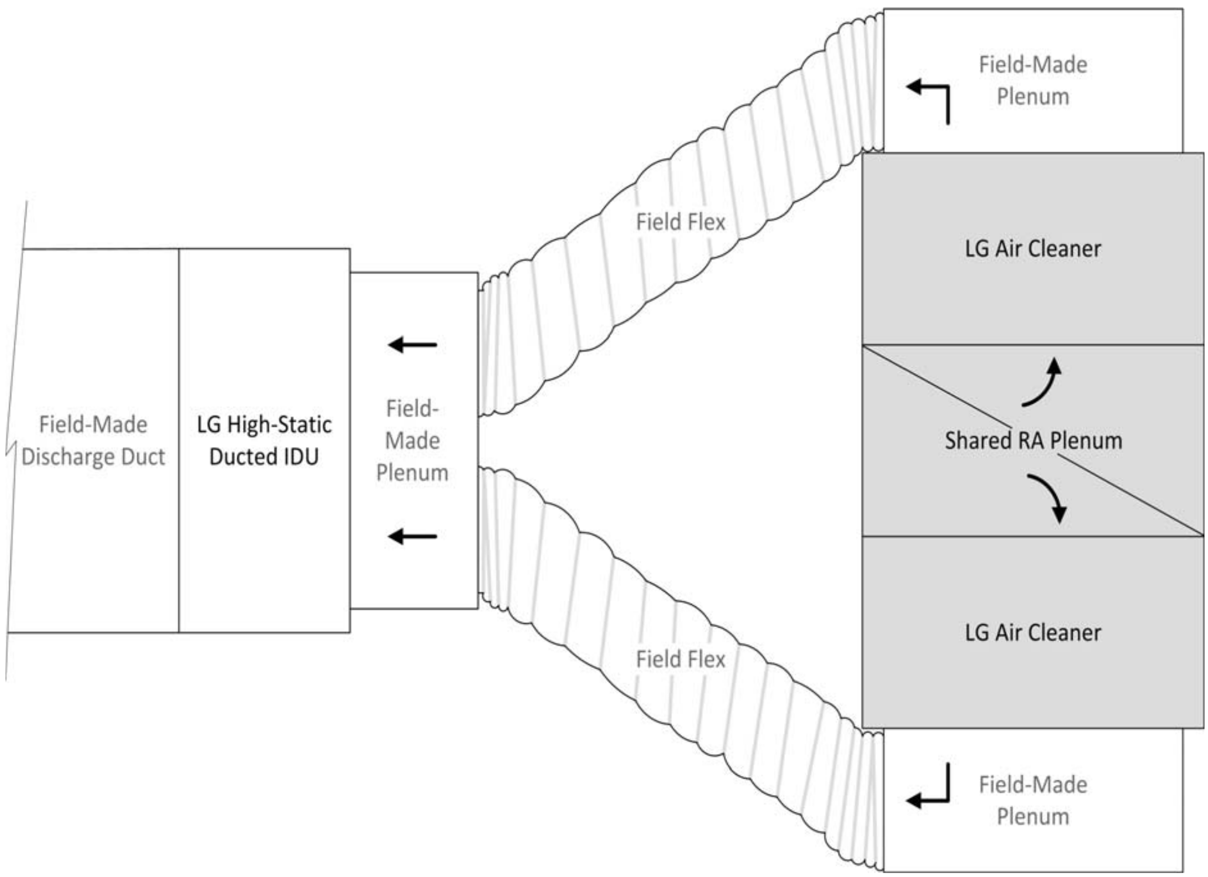
Figure 6: Plan view of S1R1 and L1R1.



Configurations S2R1, L2R1, and L1S1R1

Two Dynamic V8 Air Cleaners and one return-air plenum as shown in Figure 7 on page 15. As before, these configurations only differ in whether the engineer decides to use standard- or low-profile air cleaners, return-air plenums, and supporting ductwork. These configurations require more field-provided ductwork.

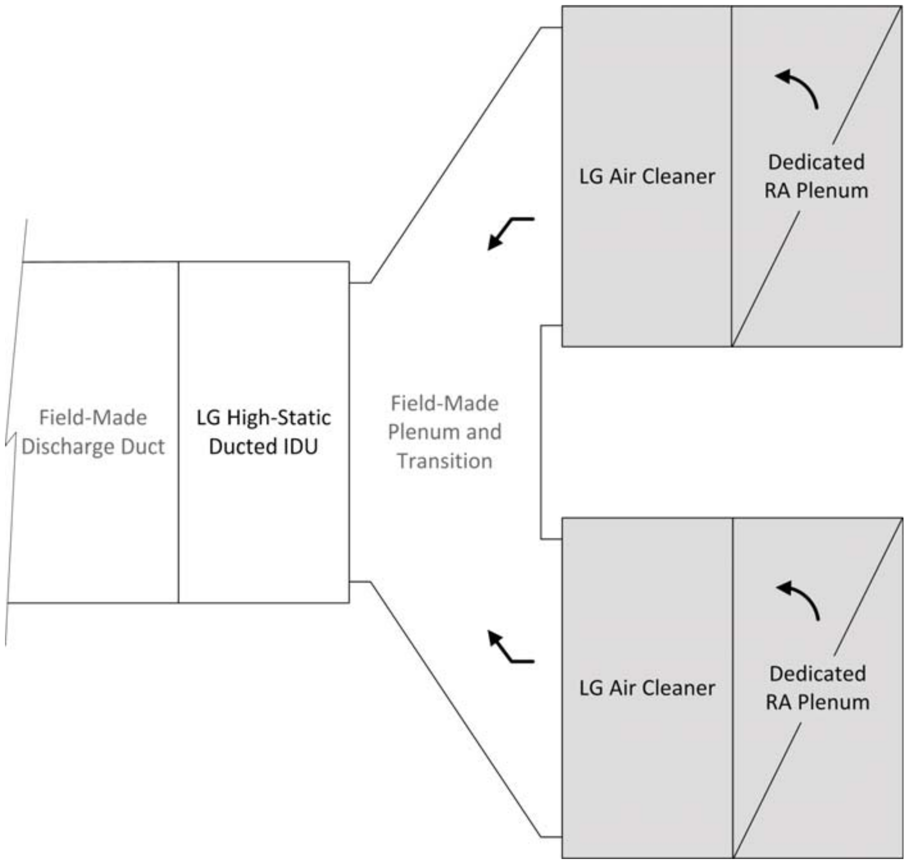
Figure 7: Plan view of S2R1, L2R1, and L1S1R1.



Configurations S2R2, L2R2, and L1S1R2

Two Dynamic V8 Air Cleaners and two return air plenums as shown in Figure 8 on page 16. As before, these configurations only differ in the engineer decides to use a standard- or low-profile air cleaners, return-air plenums, and supporting ductwork.

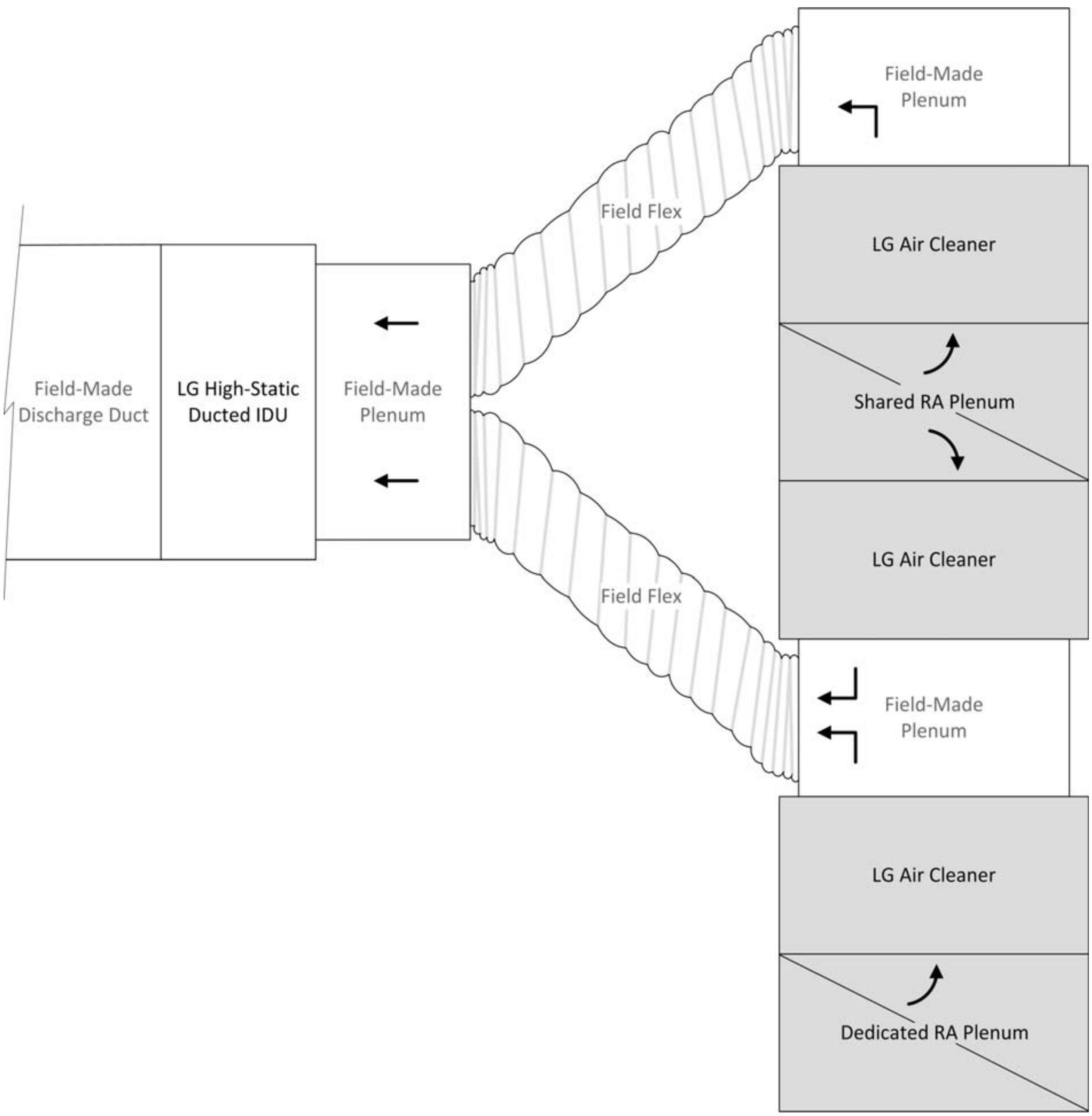
Figure 8: Plan view of S2R2, L2R2, and L1S1R2



Configurations S3R2 and L3R2

Three Dynamic V8 Air Cleaners and two return air plenums as shown in Figure 9 on page 17. As with the other configurations, these only differ in whether the engineer decides to use standard- or low-profile air cleaners, return-air plenums, and supporting ductwork. These configurations include some field-provided oversized flexible ducting.

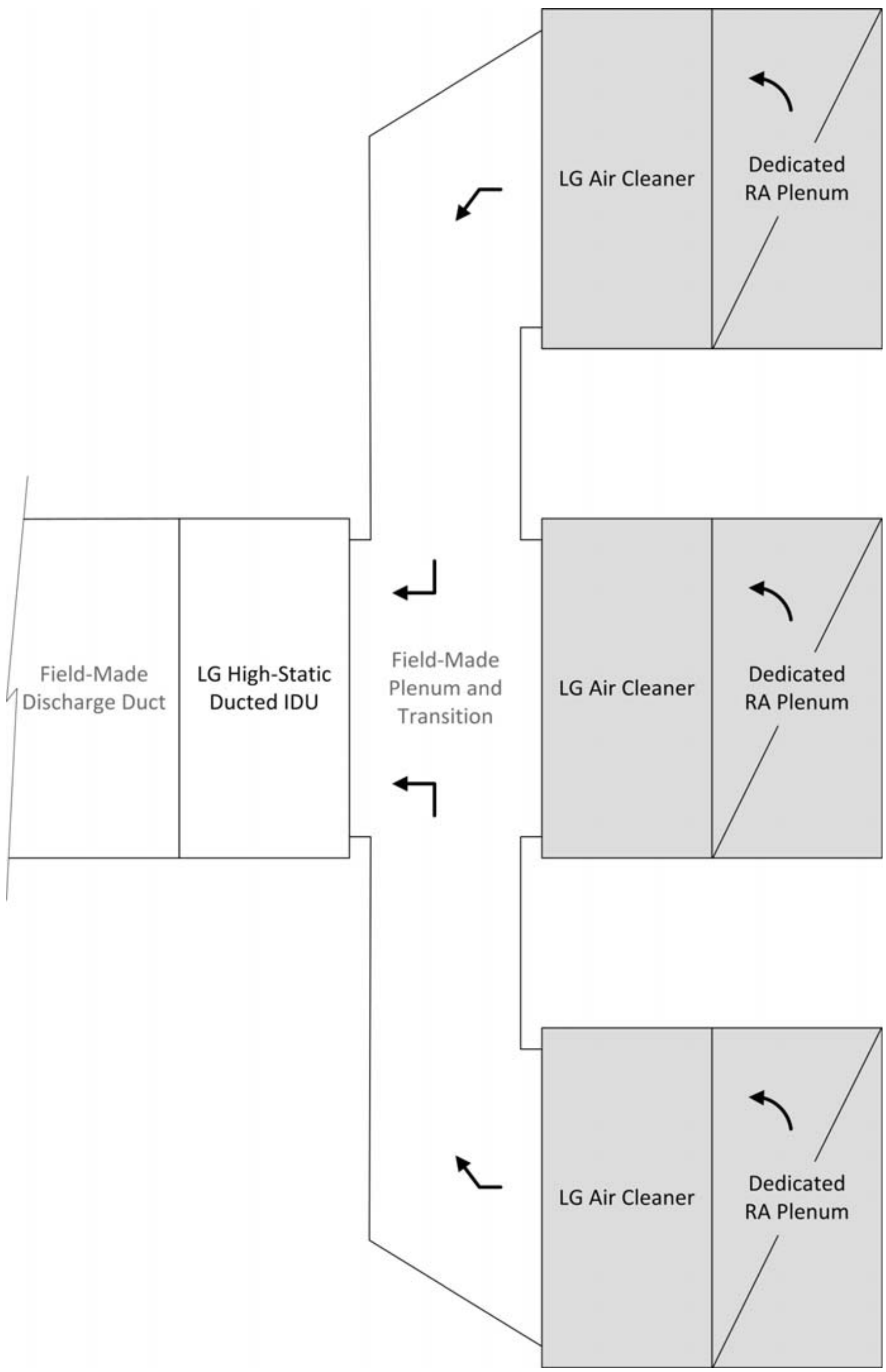
Figure 9: Plan view of S3R2 and L3R2.



Configurations S3R3 and L3R3

Three Dynamic V8 Air Cleaners and three return air plenums as shown in Figure 10 on page 18. As before, these configurations only differ in whether you use standard- or low-profile air cleaners, return-air plenums, and supporting ductwork.

Figure 10: Plan view of S3R3 and L3R3.

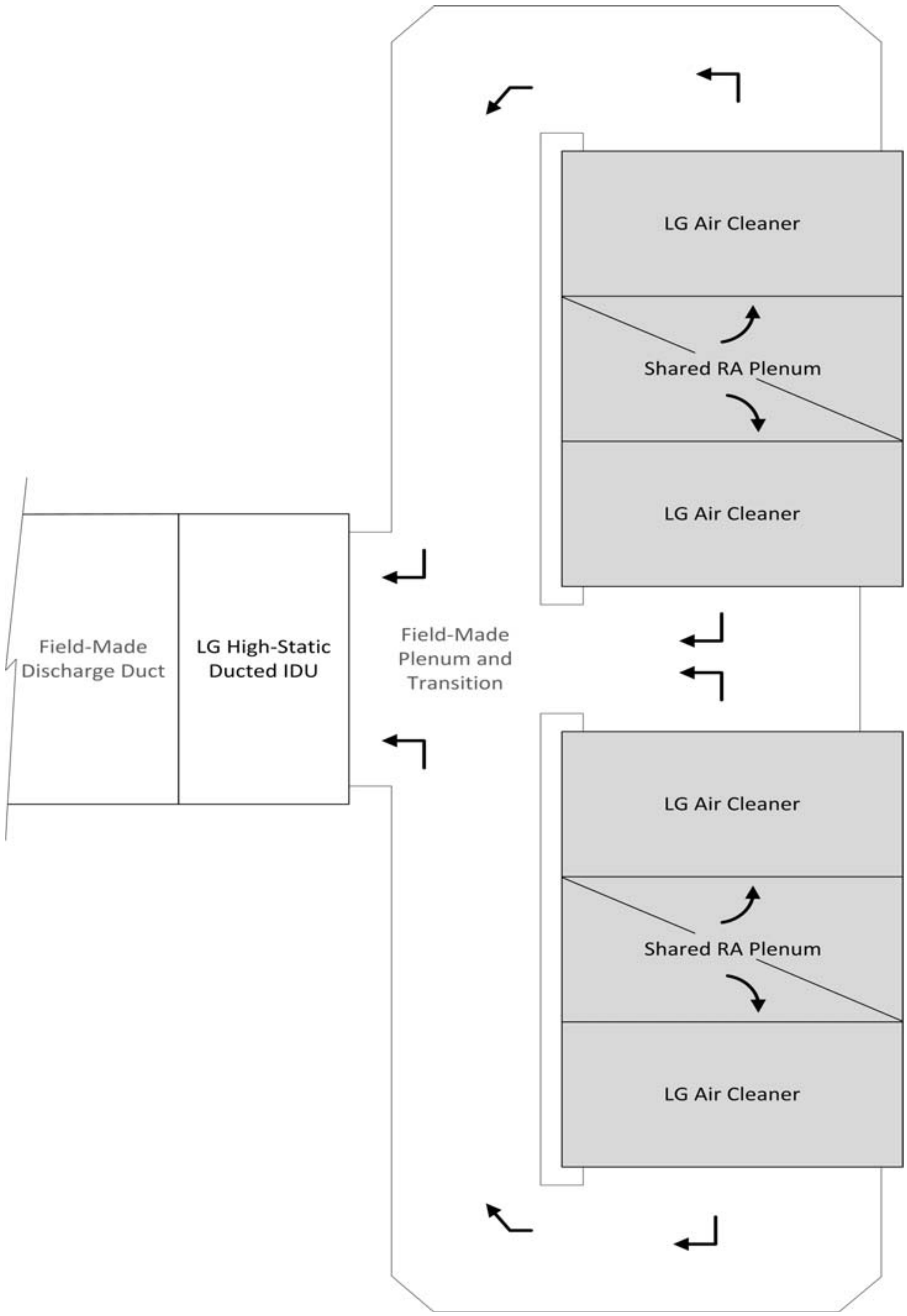


Note: An L5R3 configuration is possible; however it is not the most economical solution.

Configuration L4R2

Four Dynamic V8 Air Cleaners and two return air plenums as shown in Figure 11 on page 19..

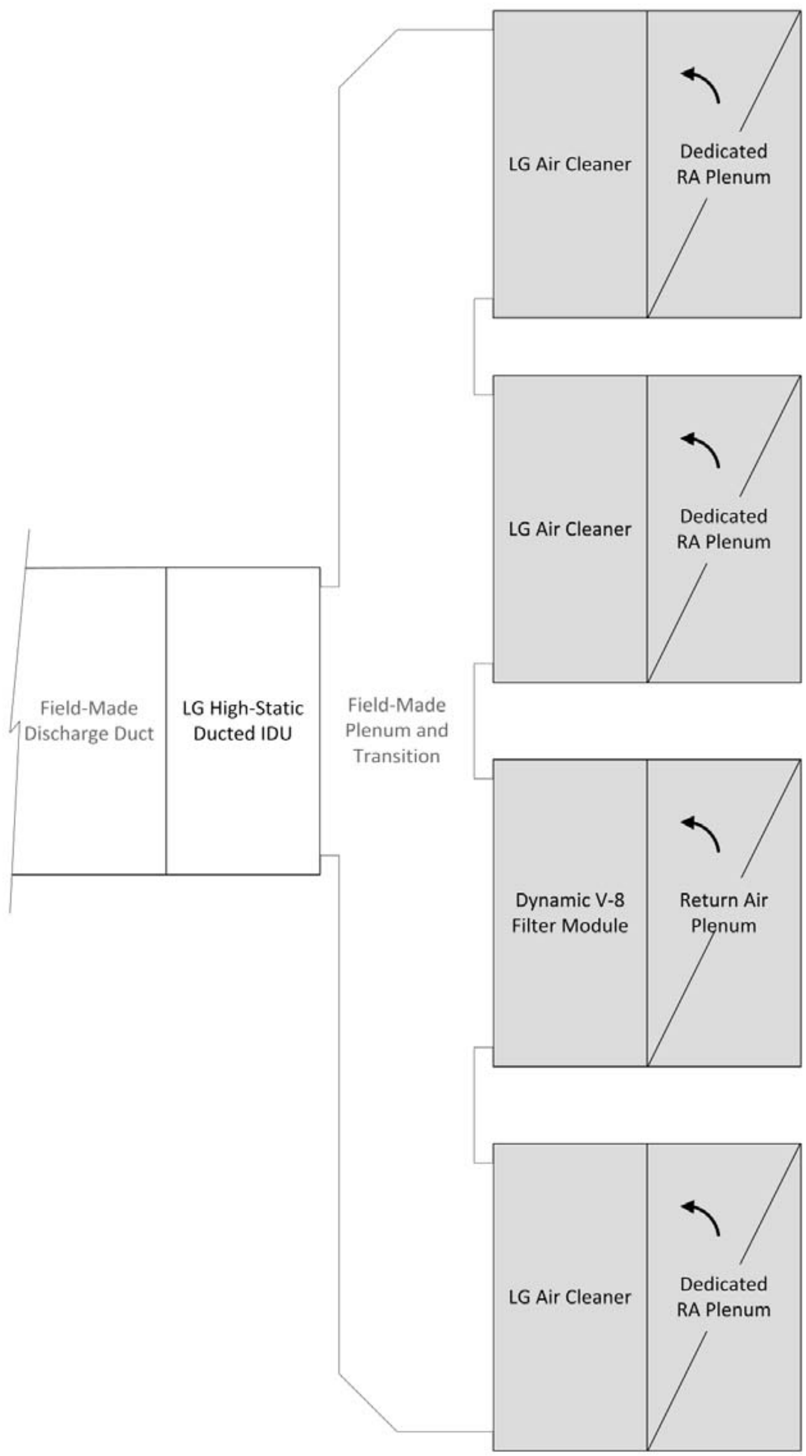
Figure 11: Plan view of S4R2.



Configuration L4R4

Four Dynamic V8 Air Cleaners and four return air plenums as shown in Figure 17 on page 20.

Figure 12: Plan view of S4R4.



Sizing Ductwork

For each indoor unit (IDU) and air cleaner configuration, Table 3 to Table 5 provide Multi V high-static IDU fan performance information and air pressure drop data that is useful when designing interconnecting ductwork. Design the duct system so that the air pressure drop (excluding the air cleaner and Multi V IDU) does not exceed the value listed under the column “Field-Provided Elements Max. Static PD with Dirty Media (in-wg).” If the designs’s air pressure drop is less than the limit provided, increase the specified dirty media Δ APD and change media condition APD values by the difference.

Table 3: 4VL Fan Setup and External Static Pressure Allocation

LG IDU Model	IDU Fan CFM[1]	IDU Fan Setting Value[2]	Available Configurations	Air Cleaner Quantity	RA Plenum Quantity	Air Cleaner (CFM/each)	Media Free Area (sq.ft.)	Media Face Velocity (FPM)	IDU External Static Pressure Rating (in-wg)	Clean Media APD (in-wg)	Dirty Media Δ APD (in-wg)	Change Media Condition APD (in-wg)	Field-Provided Elements Max Static PD with Dirty Media (in-wg)[3]
ARNU073BHA2	300	137	S1R1	1	1	300	21.4	14	0.47	0.03	0.20	0.23	0.24
ARNU093BHA2	353	141	S1R1	1	1	353	21.4	16.5	0.47	0.04	0.19	0.23	0.24
ARNU123BHA2	424	146	S1R1	1	1	424	21.4	19.8	0.47	0.05	0.17	0.22	0.25
ARNU153BGA2	487	139	S1R1	1	1	487	21.4	22.7	0.62	0.06	0.31	0.37	0.25
ARNU153BHA2	477	150	S1R1	1	1	477	21.4	22.3	0.47	0.06	0.16	0.22	0.25
ARNU183BGA2	537	141	S1R1	1	1	537	21.4	25.1	0.62	0.08	0.29	0.37	0.25
ARNU183BHA2	547	150	S1R1	1	1	547	21.4	25.5	0.47	0.08	0.14	0.22	0.25
ARNU243BGA2	671	111	S1R1	1	1	671	21.4	31.3	0.62	0.11	0.26	0.37	0.25
ARNU243BHA2	646	150	S1R1	1	1	646	21.4	30.2	0.47	0.10	0.12	0.22	0.25
ARNU283BGA2	915	160	S1R1	1	1	915	21.4	42.7	0.55	0.18	0.13	0.31	0.24
ARNU363BGA2	1141	160	S2R1	2	1	571	42.8	26.6	0.47	0.08	0.14	0.22	0.25
			S2R2	2	2	571	42.8	26.6	0.47	0.08	0.14	0.22	0.25
ARNU423BGA2	1218	160	S3R2	3	2	406	64.3	19.0	0.39	0.05	0.12	0.17	0.22
			S3R3	3	3	406	64.3	19.0	0.39	0.05	0.12	0.17	0.22
ARNU483BRA2	1582	126	S2R1	2	1	791	42.8	36.9	0.78	0.14	0.22	0.36	0.42
			S2R2	2	2	791	42.8	36.9	0.78	0.14	0.22	0.36	0.42
ARNU543BRA2	1800	126	S2R1	2	1	900	42.8	42.0	0.62	0.17	0.12	0.29	.033
			S2R2	2	2	900	42.8	42.0	0.62	0.17	0.12	0.29	.033
ARNU763B8A2	2119	105	S2R1	2	1	1060	42.8	49.5	0.92	0.22	0.20	0.42	0.50
			S2R2	2	2	1060	42.8	49.5	0.92	0.22	0.20	0.42	0.50
ARNU963B8A2	2542	105	S2R1	2	1	1271	42.8	59.3	0.84	0.30	0.12	0.42	0.42
			S2R2	2	2	1271	42.8	59.3	0.84	0.30	0.12	0.42	0.42

1. High mode, fan operating at high speed.
2. Varies from factory setting value. Must be set by the commissioning agent at startup. Anticipate the noise level of the IDU to change from cataloged values after the fan setting value is adjusted.
3 Based on the static pressure drop of the interconnecting return-air ductwork, discharge ductwork, and supply registers, the allotted static pressure listed may not be needed. In these cases, the change filter condition APD may be adjusted up.-

Table 4: 2VL Fan Setup and External Static Pressure Allocation

LG IDU Model	IDU Fan CFM[1]	IDU Fan Setting Value[2]	Available Configurations	Air Cleaner Quantity	RA Plenum Quantity	Air Cleaner (CFM/each)	Media Free Area (sq.ft.)	Media Face Velocity (FPM)	IDU External Static Pressure Rating (in-wg)	Clean Media APD (in-wg)	Dirty Media Δ APD (in-wg)	Change Media Condition APD (in-wg)	Field-Provided Elements Max Static PD with Dirty Media (in-wg)[3]
ARNU073BHA2	300	137	L1R1	1	1	300	10.7	28.0	0.47	0.09	0.12	0.21	0.26
ARNU093BHA2	353	141	L1R1	1	1	353	10.7	33.0	0.47	0.12	0.12	0.24	0.23
ARNU123BHA2	424	146	L1R1	1	1	424	10.7	39.6	0.47	0.16	0.12	0.28	0.19
ARNU153BGA2	487	139	L1R1	1	1	487	10.7	45.5	0.62	0.20	0.18	0.38	0.24
ARNU153BHA2	477	150	L1R1	1	1	477	10.7	44.5	0.47	0.19	0.12	0.31	0.16
ARNU183BGA2	537	141	L1R1	1	1	537	10.7	50.1	0.62	0.23	0.15	0.38	0.24
ARNU183BHA2	547	150	L2R1	2	1	274	21.4	25.5	0.47	0.08	0.15	0.23	0.24
			L2R2	2	2	274	21.4	25.5	0.47	0.08	0.15	0.23	0.24
ARNU243BGA2	671	111	L2R1	2	1	336	21.4	31.3	0.62	0.11	0.26	0.37	0.25
ARNU243BHA2	646	150	L2R1	2	1	323	21.4	30.2	0.47	0.10	0.12	0.22	0.25
			L2R2	2	2	323	21.4	30.2	0.47	0.10	0.12	0.22	0.25
ARNU283BGA2	915	160	L2R1	2	1	458	21.4	42.7	0.55	0.18	0.12	0.30	0.25
			L2R2	2	2	458	21.4	42.7	0.55	0.18	0.12	0.30	0.25
ARNU363BGA2	1141	160	L3R2	3	2	380	32.1	35.5	0.47	0.13	0.12	0.25	0.22
			L3R3	3	3	380	32.1	35.5	0.47	0.13	0.12	0.25	0.22
ARNU423BGA2	1218	160	L5R3	5	3	244	53.5	22.7	0.39	0.06	0.12	0.18	0.21
ARNU483BRA2	1582	126	L3R2	3	2	527	32.1	49.2	0.78	0.22	0.28	0.50	0.28
			L3R3	3	3	527	32.1	49.2	0.78	0.22	0.28	0.50	0.28
ARNU543BRA2	1800	126	L3R2	3	2	600	32.1	56.1	0.62	0.28	0.12	0.40	0.23
			L3R3	3	3	600	32.1	56.1	0.62	0.28	0.12	0.40	0.23
ARNU763B8A2	2119	105	L4R2	4	2	530	42.8	49.5	0.92	0.23	0.42	0.65	0.28
			L4R4	4	4	530	42.8	49.5	0.92	0.23	0.42	0.65	0.28
ARNU963B8A2	2542	105	L3R2	3	2	847	32.1	79.1	0.84	0.48	0.12	0.60	0.24
			L3R3	3	3	847	32.1	79.1	0.84	0.48	0.12	0.60	0.24

1. High mode, fan operating at high speed.
2. Varies from factory setting value. Must be set by the commissioning agent at startup. Anticipate the noise level of the IDU to change from cataloged values after the fan setting value is adjusted.
3 Based on the static pressure drop of the interconnecting return-air ductwork, discharge ductwork, and supply registers, the allotted static pressure listed may not be needed. In these cases, the change filter condition APD may be adjusted up.-

Table 5: 2VL with 4VL Fan Setup and External Static Pressure Allocation

LG IDU Model	IDU Fan CFM[1]	IDU Fan Setting Value[2]	Available Configurations	RA Plenum Quantity	Air Cleaner	Air Cleaner Quantity	Air Cleaner (CFM/each)	Media Free Area (sq.ft.)	Media Face Velocity (FPM)	IDU External Static Pressure Rating (in-wg)	Media Clean APD (in-wg)	Dirty Media Δ APD (in-wg)	Change Media Condition APD (in-wg)	Field-Provided Elements Max Static PD with Dirty Media (in-wg)[3]
ARNU363BGA2	1141	160	L1S1R1	1	4VL:	1	761	21.4	35.5	0.47	0.13	0.12	0.25	0.22
					2VL:	1	380	10.7	35.5	0.47	0.13	0.12	0.25	0.22
			L1S1R2	2	4VL:	1	761	21.4	35.5	0.47	0.13	0.12	0.25	0.22
					2VL:	1	380	10.7	35.5	0.47	0.13	0.12	0.25	0.22
ARNU483BRA2	1582	126	L1S1R1	1	4VL:	1	1056	21.4	49.2	0.78	0.22	0.28	0.50	0.28
					2VL:	1	526	10.7	49.2	0.78	0.22	0.28	0.50	0.28
			L1S1R2	2	4VL:	1	1056	21.4	49.2	0.78	0.22	0.28	0.50	0.28
					2VL:	1	526	10.7	49.2	0.78	0.22	0.28	0.50	0.28
ARNU543BRA2	1801	126	L1S1R1	1	4VL:	1	1202	21.4	55.9	0.62	0.27	0.12	0.39	0.23
					2VL:	1	599	10.7	55.9	0.62	0.27	0.12	0.39	0.23
			L1S1R2	2	4VL:	1	1202	21.4	55.9	0.62	0.27	0.12	0.39	0.23
					2VL:	1	599	10.7	55.9	0.62	0.27	0.12	0.39	0.23
ARNU763B8A2	2119	105	L1S1R1	1	4VL:	1	1415	21.4	66.0	0.92	0.36	0.12	0.48	0.44
					2VL:	1	704	10.7	66.0	0.92	0.36	0.12	0.48	0.44
			L1S1R2	2	4VL:	1	1415	21.4	66.0	0.92	0.36	0.12	0.48	0.44
					2VL:	1	704	10.7	66.0	0.92	0.36	0.12	0.48	0.44
ARNU963B8A2	2542	105	L1S1R1	1	4VL:	1	1697	21.4	79.0	0.84	0.48	0.12	0.60	0.24
					2VL:	1	845	10.7	79.0	0.84	0.48	0.12	0.60	0.24
			L1S1R2	2	4VL:	1	1697	21.4	79.0	0.84	0.48	0.12	0.60	0.24
					2VL:	1	845	10.7	79.0	0.84	0.48	0.12	0.60	0.24

1. High mode, fan operating at high speed.
2. Varies from factory setting value. Must be set by the commissioning agent at startup. Anticipate the noise level of the IDU to change from cataloged values after the fan setting value is adjusted.
3 Based on the static pressure drop of the interconnecting return-air ductwork, discharge ductwork, and supply registers, the allotted static pressure listed may not be needed. In these cases, the change filter condition APD may be adjusted up.-

4VL Air Cleaner Performance Data

Figure 13: 4VL air pressure drop (in-wg) vs. airflow (CFM).

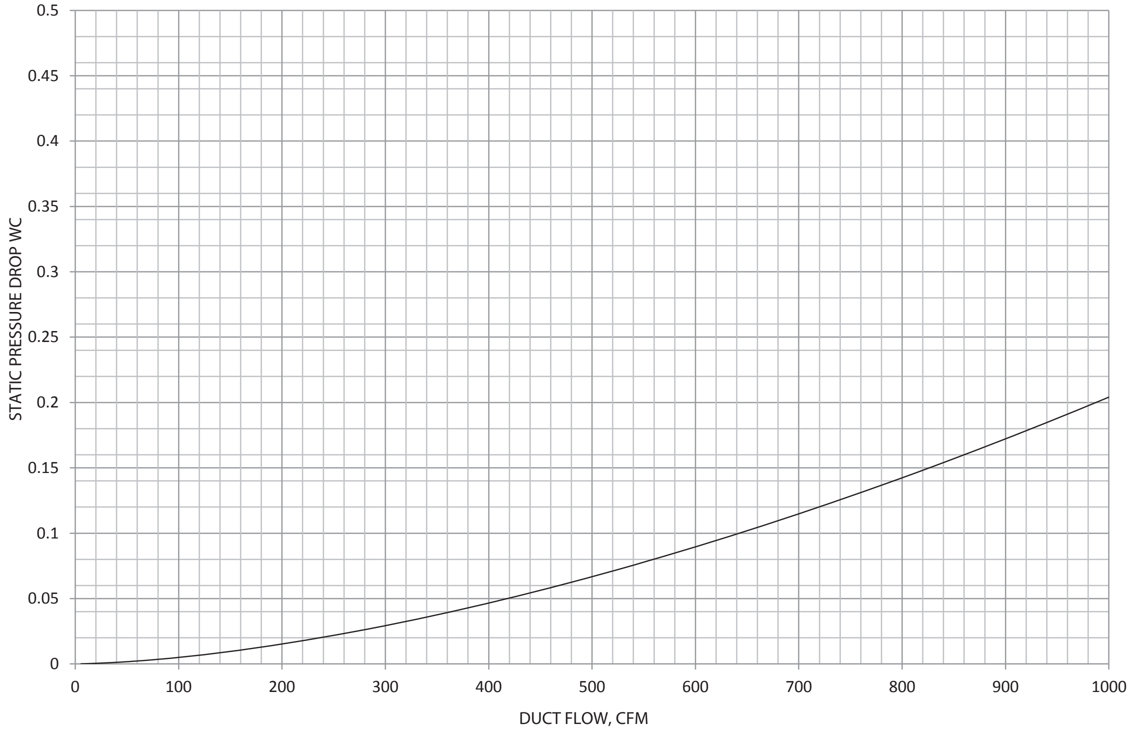
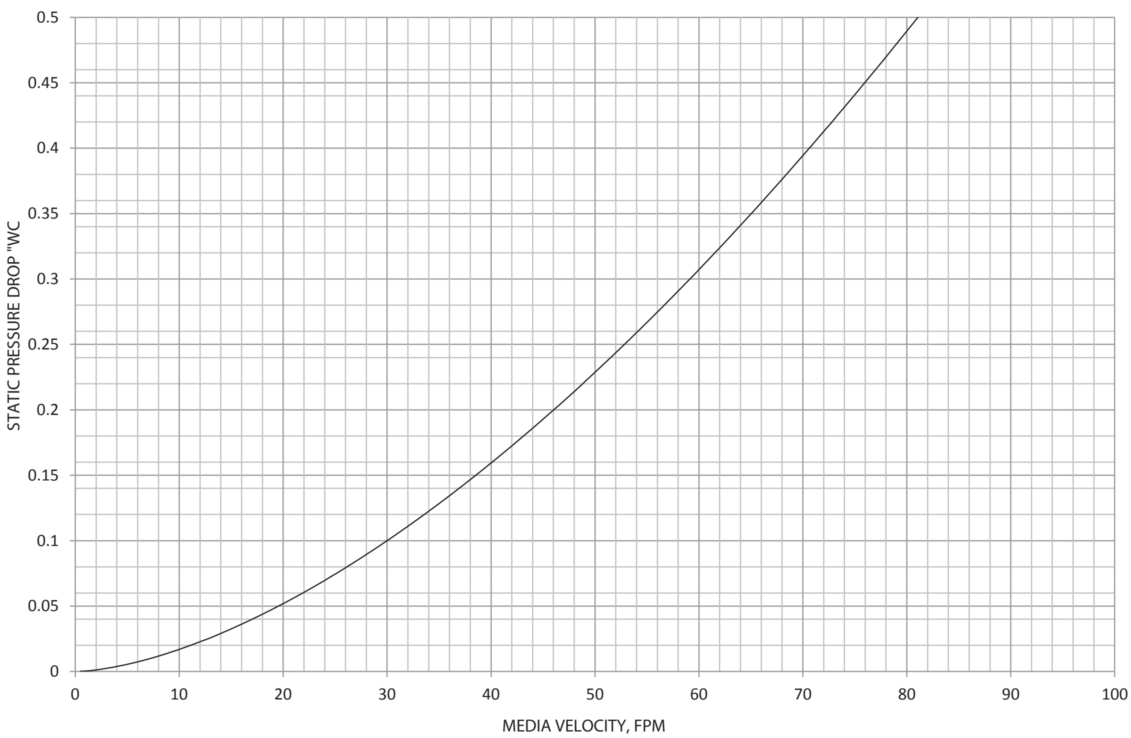


Figure 14: 4VL air pressure drop (in-wg) vs. media face velocity (fpm).



2VL Air Cleaner Performance Data

Figure 15: 2VL air pressure drop (in-wg) vs. airflow (CFM).

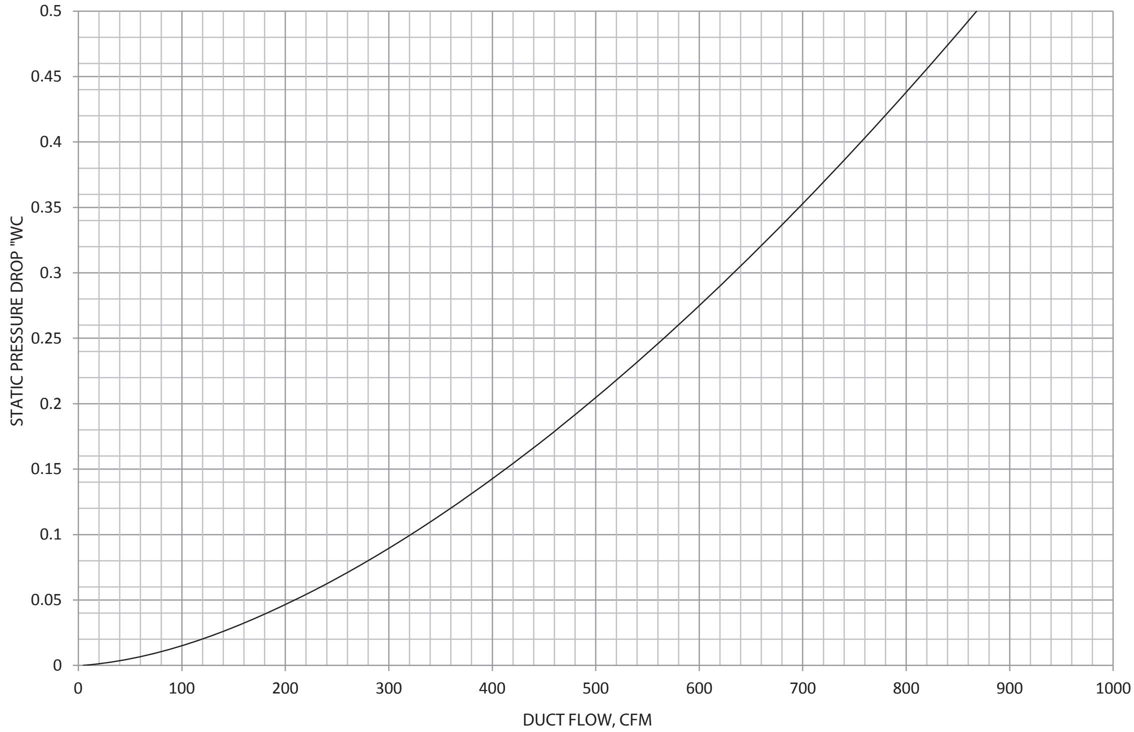
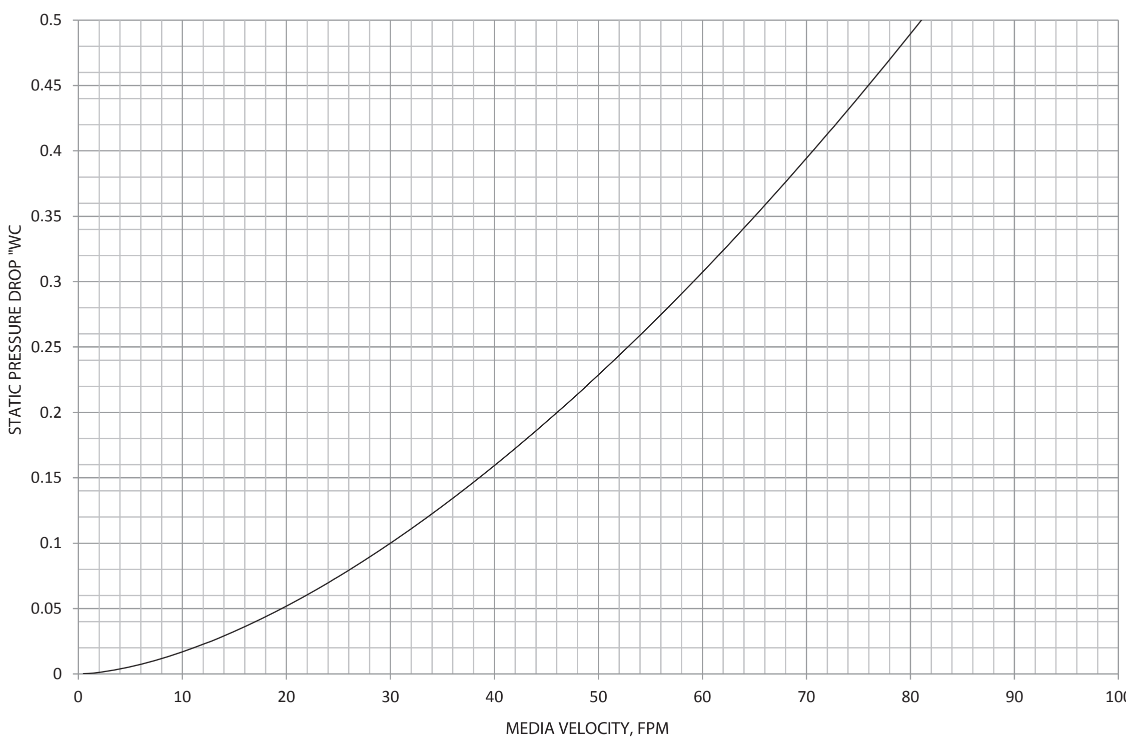


Figure 16: 2VL air pressure drop (in-wg) vs. media face velocity (fpm).



Test Results

Media Testing Standards

Air Cleaner Media Testing

Multiple test protocols have been developed over the years to measure passive media's ability to remove different sizes of airborne particulate. None of the mainstream, popular test protocols provide a way to measure the media's ability to remove gas-phase contaminants.

In an effort to present the value of the Dynamic V8 media, the following lab tests were conducted:

- Single-pass efficiency without power applied (MERV)
- Single-pass efficiency with power (polarized) (MERV-NC)
- Multiple pass to equilibrium (AHAM chamber)

Similarly, the following real-world tests were conducted:

- ASHRAE Headquarters Building, Atlanta, Georgia
- In situ gas-phase-contaminant removal test

ASHRAE Loading Dust

Loading dust, as defined by ASHRAE Standard 52.2-2007, consists of particulate ranging in size from 0.3 microns up to 10 microns in diameter and is composed of, by weight 72% SAE Standard J726 test dust (fine), 23% powdered carbon (very conductive), and 5% milled cotton linters.

Can ASHRAE loading dust be used to test the capability of active field and electrostatic air cleaners?

According to ASHRAE it cannot. ASHRAE Standard 52.2 -2007 states on page 1 (paraphrased) the “MERV test” is not truly applicable for testing the air cleaning capabilities of electronic and passive electrostatic air cleaners using fibrous media because of the highly conductive carbon component found in the ASHRAE Loading Dust that must be used during the test to earn a MERV rating.

Does ASHRAE loading dust provide a good representation of common, real world, airborne particulate?”

Probably not because common everyday airborne dust is not conductive; however, in the absence of a universally applicable performance test designed to fairly test all types of air cleaners, the HVAC industry has relied on the single pass ASHRAE Standard 52.2-2007 MERV test.

ASHRAE Standard 52.2-2007 Protocol

ASHRAE Standard 52.2-2007 is a single-pass test protocol that was specifically developed to test passive filter media and provide engineers and building owners a way to directly compare the media's ability to capture various sizes of particulate on a standardized basis regardless of the application. After a filter test is completed, the media is graded and earns a Minimum Efficiency Reporting Value or MERV rating. The MERV rating scale ranges from 1 to 16 with 16 being the most effective. This test is commonly referred to as a "MERV test."

MERV (NC) Test Protocol

In order to test the Dynamic V8 media and earn a MERV rating using ASHRAE loading dust it required that the air cleaner media power be turned off. MERV (NC) is a variation on MERV where "NC" designates that the ASHRAE Standard 52.2 test protocol was followed using non-conductive loading dust. Non-conductive loading dust is ASHRAE loading dust without the carbon component. During this test, the Dynamic V8 media is powered and polarized.

Dynamic V8 MERV Test Results

The Dynamic V8 was tested by an independent third-party laboratory located in the U.S.A. using the ASHRAE 52.2-2007 test protocol, using standard conductive ASHRAE loading dust. The test was performed without the Dynamic V8 energized (no polarization) because of the presense of conductive dust. The test media received a MERV rating of 13 @ 1968 CFM and held no less than 600 grams by weight of loading dust at a pressure drop of 1.4 in-wg. Refer to figures 18-20 beginning on page 31.

Dynamic V8 MERV-NC Test Results

The Dynamic V8 was tested by an independent third-party laboratory located in the U.S.A. using the ASHRAE 52.2-2007 test protocol, using standard conductive ASHRAE loading dust with the conductive black-carbon component removed. The test was performed with the Dynamic V8 turned on (polarized). The test media received a Minimum Efficiency Reporting Value Non-Conductive (MERV-NC) rating of 15 @ 1968 CFM and held no less than 2700 grams by weight of loading dust at a pressure drop of 1.4 in-wg. Refer to figures 21-23 beginning on page 32.

Note: Active field (polarized) media cannot be tested using ASHRAE Loading Dust as blended. Carbon element of ASHRAE Loading Dust is very conductive and must be removed. MERV(NC) = Minimum Efficiency Reporting Value (Non Conductive) test follows ASHRAE Standard 52.2-2007 protocol using ASHRAE loading dust LESS the carbon element.

Figure 18: Dynamic V8 MERV Test Results (page one).

Blue Heaven Technologies

2820 S. English Station Road - Louisville, KY 40299
Tel: (502) 357-0132 Fax (502) 267-8379

Date: 13-May-09 **TEST NO.** 09-836

ASHRAE Standard 52.2-2007
TEST REPORT

Filter Description

Manufacturer	Engineering Dynamics LTD
Filter Model	1V8242429.5F
Part Number	09FAFCFAF90/110G-OPTEC9.2
Generic Filter Type	Electrostatic Pocket
Nominal Dimensions (H x W x D)	24"x24x29.5"
Pocket / Pleat Quantity	8 Panels
Media Type	Polyolefin
Est. Gross Media Area	32 Ft2
Adhesive Type	3M3264 Jetmelt

Test Conditions

Loading Dust Type	ASHRAE	Test Air Temp (degrees F.)	75
Barometric Pressure (In. Hg.)	29.99	Relative Humidity (%)	49

Test Results

Airflow Rate (CFM)	**1968**
Nominal Face Velocity (fpm)	**492**
Initial Resistance (in WG)	**0.31**
Final Resistance (in WG)	**1.40**
E1 (%) Composite Minimum Avg. Efficiency 0.30 - 1.0 um	**66**
E2 (%) Composite Minimum Avg. Efficiency 1.0 - 3.0 um	**95**
E3 (%) Composite Minimum Avg. Efficiency 3.0 - 10.0 um	**100**
Minimum Efficiency Reporting Value (MERV)	**MERV 13 @ 1968 CFM**

Comments Tested For: Engineering Dynamics LTD
Dust Fed (gms) to Final Resistance: 664
Average Arrestance - 96.8%
Dust Holding Capacity - 643 Gms

Approval: [signature]

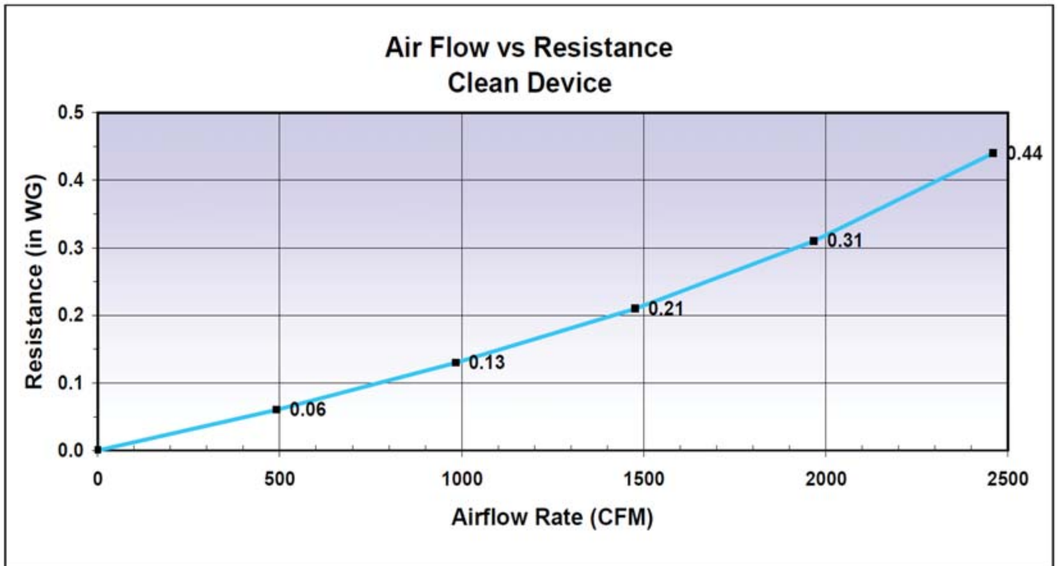
Page 1 Of 3

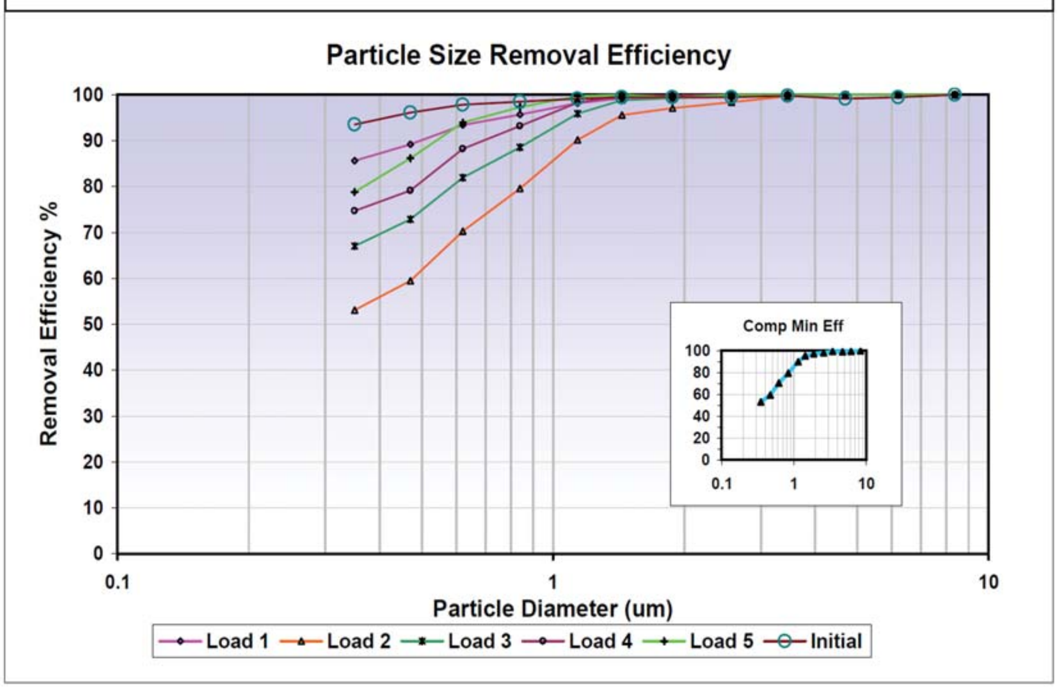
Figure 19: Dynamic V8 MERV Test Results (page two).

Blue Heaven Technologies
2820 S. ENGLISH STATION ROAD - LOUISVILLE, KY 40299
Tel: (502) 357-0132

ASHRAE Standard 52-2007
Test Report

Test No. 09-836
Date: 13-May-09





Page 2 Of 3

Figure 20: Dynamic V8 MERV Test Results (page three).

Blue Heaven Technologies
2820 S. ENGLISH STATION ROAD - LOUISVILLE, KY 40299
Tel: (502) 357-0132

ASHRAE Standard 52-2007
Test Report

Test No. 09-836
Date: 13-May-09

Data - Initial Resistance

Airflow (CFM)	Resistance (in WG)
0	0.00
492	0.06
984	0.13
1476	0.21
1968	0.31
2460	0.44

Data - Particle Removal Efficiency

Particle Size Range (um)	Geometric Mean Diam (um)	Particle Removal Efficiency (%)						
0.30 - 0.40	0.35	53.1	93.6	85.6	53.1	67.0	74.7	78.9
0.40 - 0.55	0.47	59.5	96.1	89.2	59.5	72.9	79.1	86.2
0.55 - 0.70	0.62	70.3	97.8	93.4	70.3	82.0	88.2	94.0
0.70 - 1.00	0.84	79.5	98.5	95.7	79.5	88.6	93.2	97.3
1.00 - 1.30	1.14	90.1	99.1	98.1	90.1	95.9	98.3	99.7
1.30 - 1.60	1.44	95.6	99.5	99.3	95.6	98.8	99.9	100.0
1.60 - 2.20	1.88	97.1	99.4	99.3	97.1	99.2	99.8	99.3
2.20 - 3.00	2.57	98.3	99.4	99.5	98.3	99.6	100.0	100.0
3.00 - 4.00	3.46	99.7	99.7	99.8	99.7	99.8	100.0	100.0
4.00 - 5.50	4.69	99.2	99.2	100.0	100.0	100.0	100.0	100.0
5.50 - 7.00	6.20	99.5	99.5	100.0	100.0	100.0	100.0	100.0
7.00 - 10.00	8.37	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		CME	Initial	Load 1	Load 2	Load 3	Load 4	Load 5
Resistance after Dust Load (in WG) ----->				0.33	0.58	0.86	1.13	1.40
Dust Load (gms) ----------------------------->				30	265	408	591	664

Page 3 Of 3

Figure 21: Dynamic V8 MERV-NC Test Results (page one).

Blue Heaven Technologies

2820 S. English Station Road - Louisville, KY 40299
Tel: (502) 357-0132 Fax (502) 267-8379

Date: 22-May-09 **TEST NO.** 09-838

ASHRAE Standard 52.2-2007 TEST REPORT

Filter Description

Manufacturer	Engineering Dynamics LTD
Filter Model	1V8242429.5F
Part Number	09FAFCFAF90/110G-OPTEC9.2
Generic Filter Type	Electrostatic Pocket
Nominal Dimensions (H x W x D)	24"x24"x29.5"
Pocket / Pleat Quantity	8 Panels
Media Type	Polyolefin
Est. Gross Media Area	32 Ft2
Adhesive Type	3M3264 Jetmelt

Test Conditions

Loading Dust Type	ASHRAE/No Carbon	Test Air Temp (degrees F.)	81
Barometric Pressure (In. Hg.)	30.16	Relative Humidity (%)	39

Test Results

Airflow Rate (CFM)	**1968**
Nominal Face Velocity (fpm)	**492**
Initial Resistance (in WG)	**0.32**
Final Resistance (in WG)	**1.40**
E1 (%) Composite Minimum Avg. Efficiency 0.30 - 1.0 um	**94**
E2 (%) Composite Minimum Avg. Efficiency 1.0 - 3.0 um	**99**
E3 (%) Composite Minimum Avg. Efficiency 3.0 - 10.0 um	**100**
Minimum Efficiency Reporting Value (MERV)	**MERV 15 @ 1968 CFM**

Comments
Tested For: Engineering Dynamics
Dust Fed (gms) to Final Resistance: 2781
Avg. Arrestance = 99.9%
Dust Holding Capacity = 2777.1 gms

Approval: [signature]

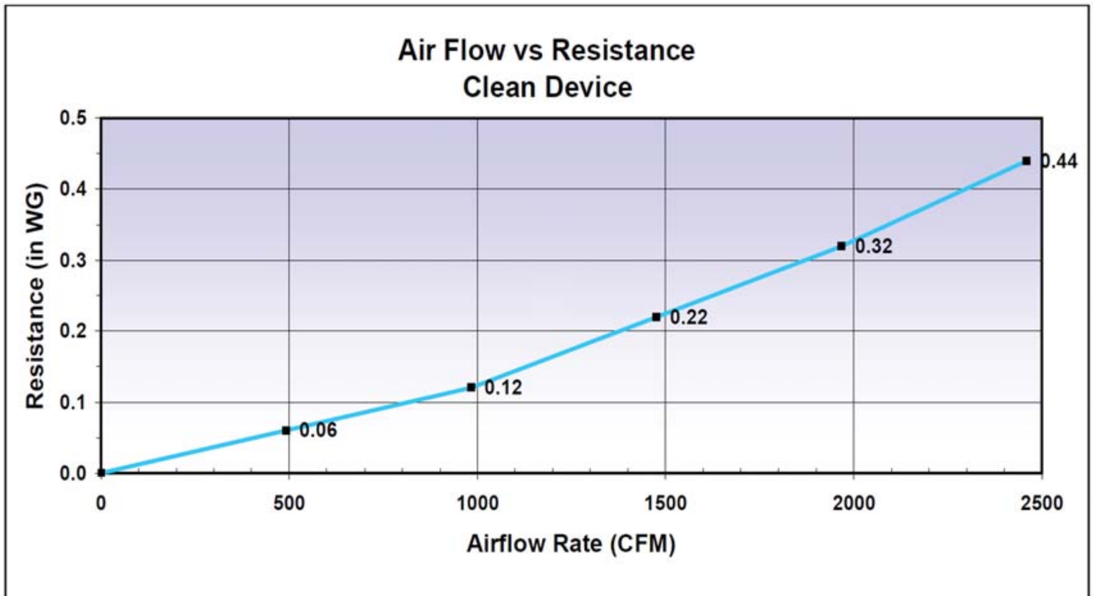
Page 1 Of 3

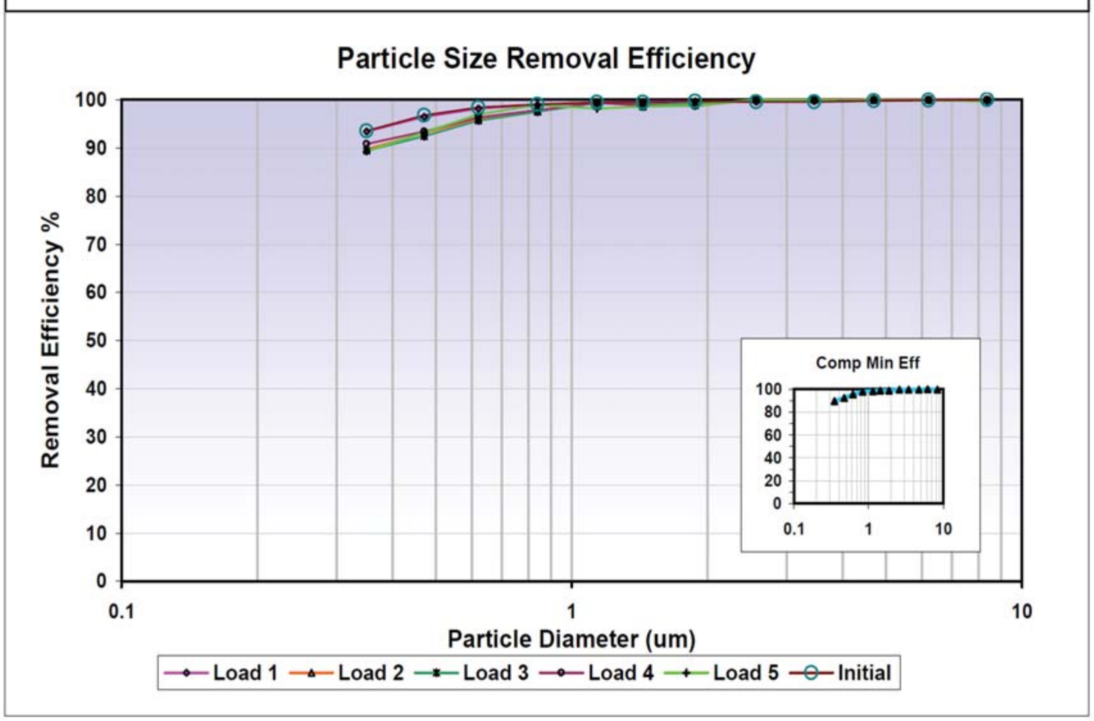
Figure 22: Dynamic V8 MERV-NC Test Results (page two).

Blue Heaven Technologies
2820 S. ENGLISH STATION ROAD - LOUISVILLE, KY 40299
Tel: (502) 357-0132

ASHRAE Standard 52-2007
Test Report

Test No. 09-838
Date: 22-May-09





Page 2 Of 3

Figure 23: Dynamic V8 MERV-NC Test Results (page three).

Blue Heaven Technologies
2820 S. ENGLISH STATION ROAD - LOUISVILLE, KY 40299
Tel: (502) 357-0132

ASHRAE Standard 52-2007
Test Report

Test No. 09-838
Date: 22-May-09

Data - Initial Resistance

Airflow (CFM)	Resistance (in WG)
0	0.00
492	0.06
984	0.12
1476	0.22
1968	0.32
2460	0.44

Data - Particle Removal Efficiency

Particle Size Range (um)	Geometric Mean Diam (um)	Particle Removal Efficiency (%)						
0.30 - 0.40	0.35	89.3	93.5	93.4	89.7	89.4	90.8	89.3
0.40 - 0.55	0.47	92.5	96.8	96.4	93.1	92.5	93.4	93.2
0.55 - 0.70	0.62	95.7	98.4	98.2	96.1	95.7	96.3	97.0
0.70 - 1.00	0.84	97.5	99.0	98.9	97.6	97.5	97.9	98.9
1.00 - 1.30	1.14	98.2	99.4	99.4	99.6	99.4	99.4	98.2
1.30 - 1.60	1.44	98.6	99.5	99.6	98.6	99.0	98.8	98.6
1.60 - 2.20	1.88	98.8	99.6	99.6	98.9	99.1	98.8	98.8
2.20 - 3.00	2.57	99.6	99.6	99.6	100.0	100.0	100.0	100.0
3.00 - 4.00	3.46	99.6	99.6	99.6	100.0	100.0	100.0	99.9
4.00 - 5.50	4.69	99.7	99.7	100.0	100.0	99.9	100.0	100.0
5.50 - 7.00	6.20	99.9	99.9	100.0	100.0	100.0	100.0	99.9
7.00 - 10.00	8.37	99.7	100.0	100.0	100.0	100.0	100.0	99.7
		CME	Initial	Load 1	Load 2	Load 3	Load 4	Load 5
Resistance after Dust Load (in WG) ----->				0.34	0.59	0.86	1.13	1.40
Dust Load (gms) ----------------------------->				30	1530	2130	2559	2781

Page 3 Of 3

Particulate Removal Multi-Pass Test

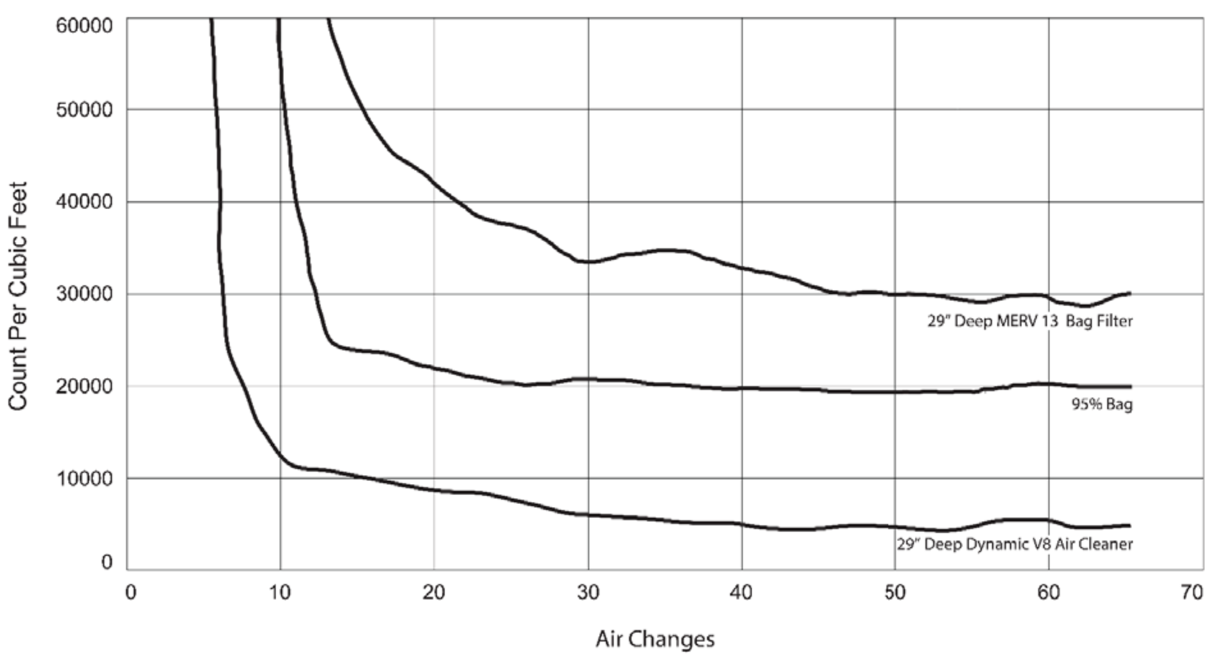
The multi-pass test modeled what occurs in the real world when air in a closed room is recirculated. Because ASHRAE does not provide a test protocol of this nature, the test was conducted using an AHAM Chamber (a chamber constructed to meet the specifications of the American Home Appliance Manufacturers). The test media had the same cross sectional area as the ASHRAE 52.2 test. The airflow rate was set at 2000 CFM resulting in a cross sectional face velocity of 500 feet per minute. The particle counter was calibrated to measure particulate that is 0.3 µm diameter, coinciding with the industry standard used for testing HEPA grade media.

Unlike the ASHRAE 52.2-2007 test, where the particle counter is placed directly upstream and downstream of the air cleaner media, the focus of this test protocol is to measure the airborne particle count in the chamber. Therefore, the calibrated particle counter was placed in the center of the chamber.

The loading dust used was 100% SAE Standard J726 dust (fine). The loading dust is introduced to the chamber until the particle concentration rose to 60,000 particles per ft^3. No additional particulate was introduced to the chamber once the test began. The test continued for a minimum of 60 air changes or until the particulate concentration level reached equilibrium, whichever period was longer.

Notice the performance of the Dynamic V8 compared with traditional passive bag media. The airborne particulate count density at equilibrium was reduced to approximately 5,000/ft^3 for the Dynamic V8 media compared with 20,000/ft^3 for the MERV 14 bag and 30,000/ft^3 for the MERV 13 bag.

Figure 24: Concentration level of 0.30 µm particulate versus air changes.



Dynamic V8 Air Cleaner Engineering Manual

ASHRAE Office-Building Field Test

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) installed Dynamic V8 air cleaner media in their LEED® Platinum Office Building in Atlanta, Georgia. The HVAC systems installed consisted of a combination of variable-refrigerant-flow fan-coil indoor units and water-source heat pumps. The air pressure drops across each air cleaner has been monitored regularly ever since. After four years of operation, the original Dynamic V8 media is still removing airborne particulate, ultra fine particulate, and gas phase contaminants with the air pressure drop across the media rising only slightly. Based on the air pressure drop performance data gathered, it is anticipated the media will remain in service for a couple more years before it reaches the end of its useful service life.

In-Situ Gas-Phase Contaminant Removal Test

The purpose of the in-Situ Test is to measure the air cleaner's capability of removing airborne volatile organic compounds (VOCs) over a 24-hour period in a building. During the test, the airborne VOC concentration level was measured to be as high as 300 $\mu g/m^3$.

Dynamic V8 media was installed in a hospital in northern central region of the United States. The test protocol included mounting a calibrated Total Volatile Organic Chemical (TVOC) meter upstream of the air cleaner and a second calibrated meter downstream. The test was conducted for a continuous 24-hour period.

The concentration level of airborne VOCs was measured every three minutes for the testing period. The upstream meter indicated rising and falling TVOC levels in the breathing zone for the 24-hour period. As time progressed, the amount of gas phase contaminants in circulation began to dwindle. After eight hours and five minutes of operation, the downstream meter indicated the air cleaner media was operating at 100% efficiency, removing all volatile organic chemicals from the air passing through the media. The downstream meter recorded no measurable VOCs (0.0 $\mu g/m^3$) for the following sixteen hours and twenty-two minutes of the testing period. Refer to the following table for the recorded levels at each hour of the test.

Table 6: In Situ Test – Hourly Measured VOC Concentration Levels

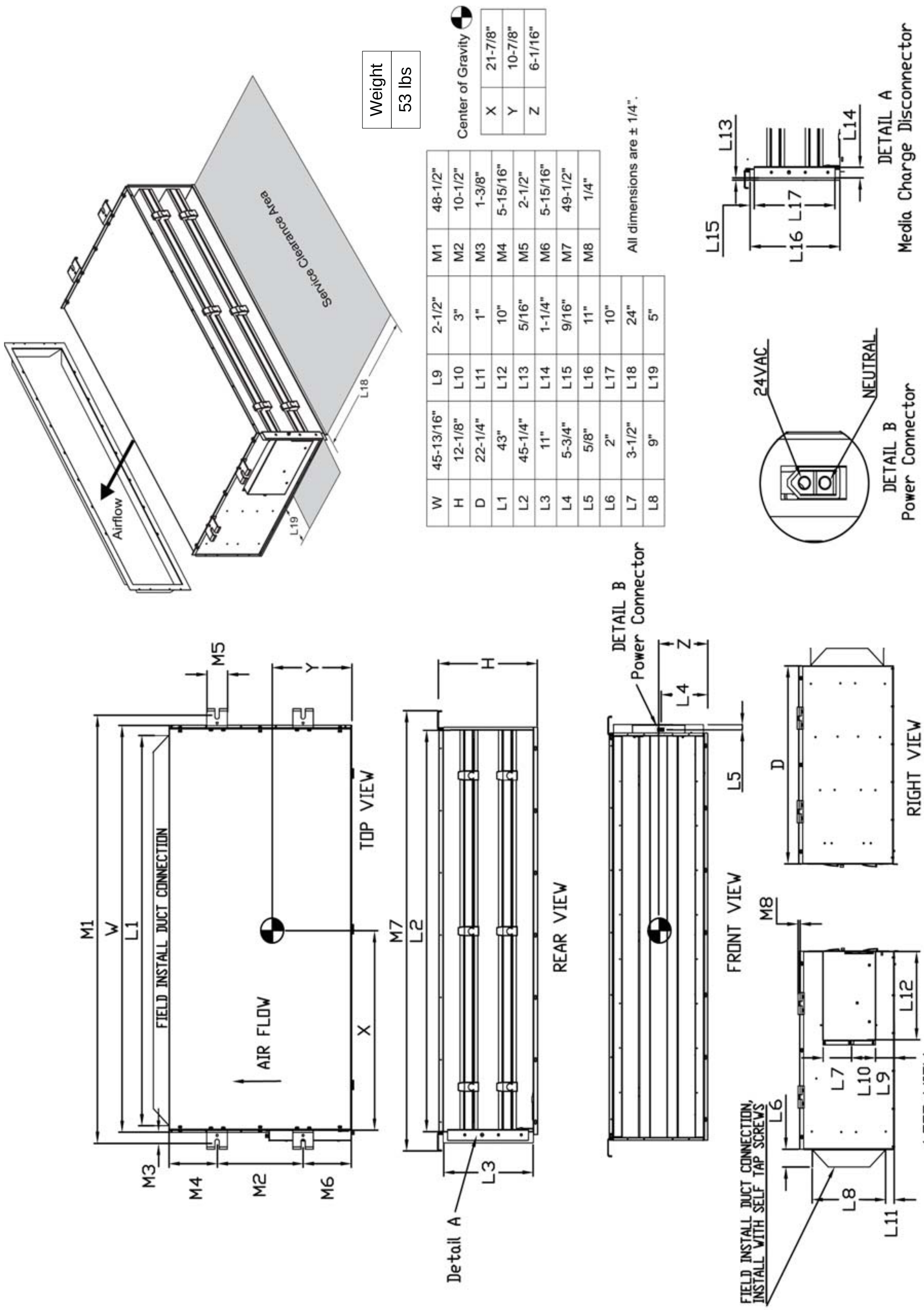
Time	Upstream TVOC (µg/m³)	Downstream TVOC (µg/m³)	% Remaining
1300	122	60	49%
1400	302	136	45%
1500	297	136	46%
1600	295	127	43%
1700	254	111	44%
1800	197	86	44%
1900	145	68	47%
2000	82	45	55%
2100	27	18	67%
2200	0	0	0%
2300	3	0	0%
0000	0	0	0%
0100	0	0	0%
0200	3	0	0%
0300	24	0	0%
0400	24	0	0%
0500	27	0	0%
0600	48	0	0%
0700	44	0	0%
0800	43	0	0%
0900	0	0	0%
1000	0	0	0%
1100	58	0	0%
1200	42	0	0%

LG
Life's Good

Cut Sheets

Dynamic V8 4VL Air Cleaner

Figure 25: Dynamic V8 4VL Air Cleaner.



W	45-13/16"	L9	2-1/2"	M1	48-1/2"
H	12-1/8"	L10	3"	M2	10-1/2"
D	22-1/4"	L11	1"	M3	1-3/8"
L1	43"	L12	10"	M4	5-15/16"
L2	45-1/4"	L13	5/16"	M5	2-1/2"
L3	11"	L14	1-1/4"	M6	5-15/16"
L4	5-3/4"	L15	9/16"	M7	49-1/2"
L5	5/8"	L16	11"	M8	1/4"
L6	2"	L17	10"		
L7	3-1/2"	L18	24"		
L8	9"	L19	5"		

All dimensions are ± 1/4".

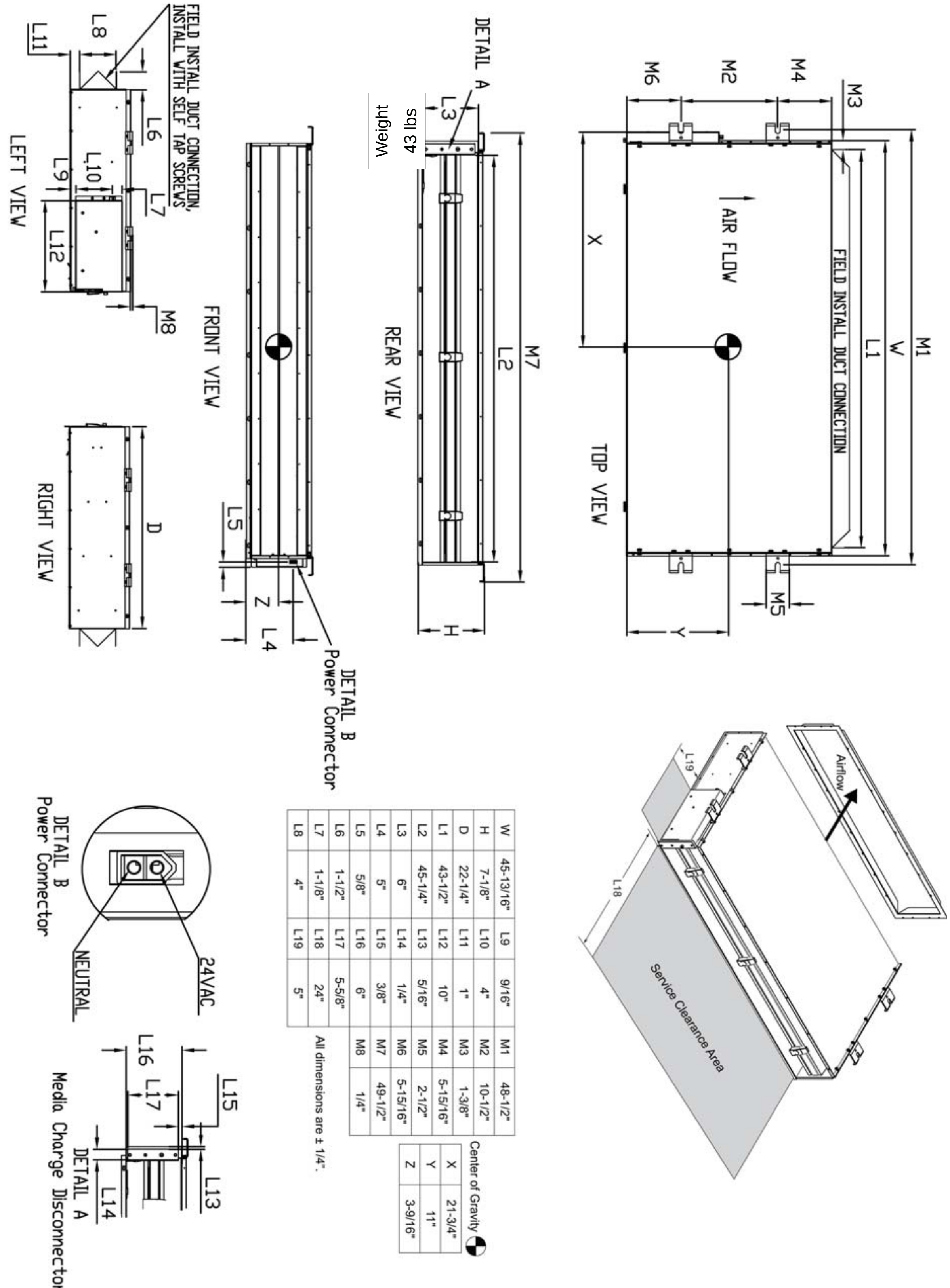
Weight	
	53 lbs

Center of Gravity

X	21-7/8"
Y	10-7/8"
Z	6-1/16"

Dynamic V8 2VL Air Cleaner

Figure 26: Dynamic V8 2VL Air Cleaner.



Weight
43 lbs

W	45-13/16"	L9	9/16"	M1	48-1/2"
H	7-1/8"	L10	4"	M2	10-1/2"
D	22-1/4"	L11	1"	M3	1-3/8"
L1	43-1/2"	L12	10"	M4	5-15/16"
L2	45-1/4"	L13	5/16"	M5	2-1/2"
L3	6"	L14	1/4"	M6	5-15/16"
L4	5"	L15	3/8"	M7	49-1/2"
L5	5/8"	L16	6"	M8	1/4"
L6	1-1/2"	L17	5-5/8"		
L7	1-1/8"	L18	24"		
L8	4"	L19	5"		

All dimensions are ± 1/4".

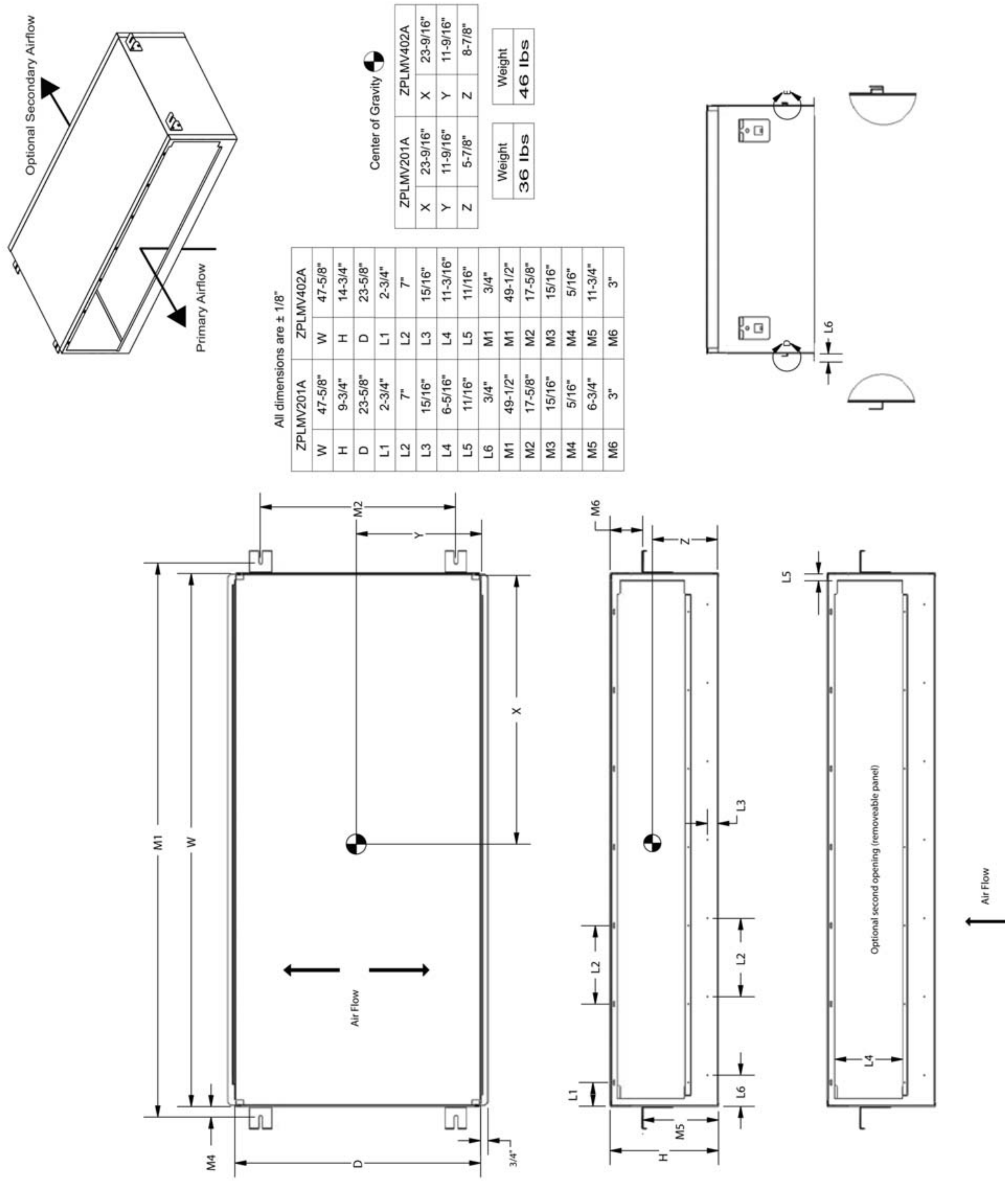
Center of Gravity

X	21-3/4"
Y	11"
Z	3-9/16"

Return-Air Plenum

The return air plenum accessory is engineered to connect directly to the Dynamic V8 air cleaner. It comes in both standard and low profile heights. It attaches in the field to the bottom of the plenum housing and ships knocked down.

Figure 27: Return-Air-Plenum Grille Housing.



Center of Gravity

ZPLMV201A	
X	23-9/16"
Y	11-9/16"
Z	5-7/8"

ZPLMV402A	
X	23-9/16"
Y	11-9/16"
Z	8-7/8"

Weight
36 lbs

Weight
46 lbs

All dimensions are ± 1/8"

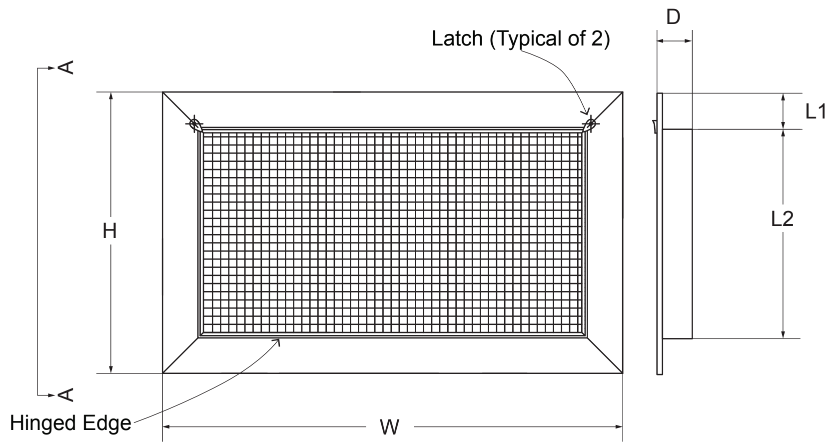
ZPLMV201A	
W	47-5/8"
H	9-3/4"
D	23-5/8"
L1	2-3/4"
L2	7"
L3	15/16"
L4	6-5/16"
L5	11/16"
L6	3/4"
M1	49-1/2"
M2	17-5/8"
M3	15/16"
M4	5/16"
M5	6-3/4"
M6	3"

ZPLMV402A	
W	47-5/8"
H	14-3/4"
D	23-5/8"
L1	2-3/4"
L2	7"
L3	15/16"
L4	11-3/16"
L5	11/16"
M1	3/4"
M1	49-1/2"
M2	17-5/8"
M3	15/16"
M4	5/16"
M5	11-3/4"
M6	3"

Egg-Crate Return-Air Grille

The return air grille attaches to the return-air plenum.

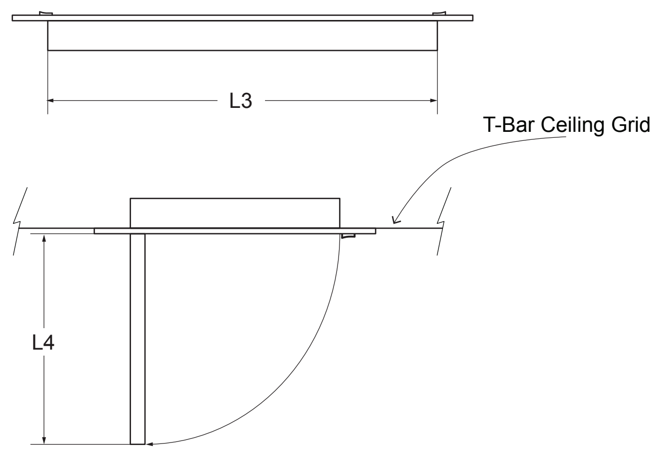
Figure 28: Egg-Crate Return-Air Grille (ZGRLRA02A).



All dimensions are ± 1/8”

W	47-3/4"
H	23-3/4"
D	1-5/8"
L1	7/8"
L2	22"
L3	46"
L4	21"

Weight
14 lbs

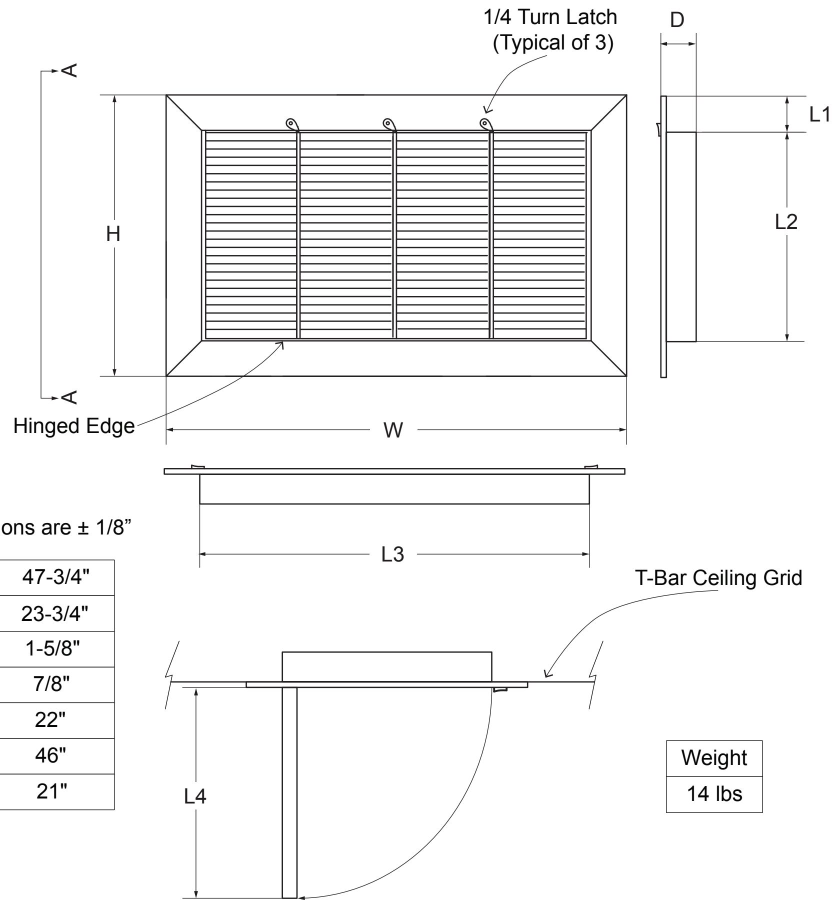


Service Clearance (Detail A-A)

Louvered Return-Air Grille

The return air grille attaches to the return-air plenum.

Figure 29: Louvered Return-Air Grille (ZGRLRA01A).



All dimensions are ± 1/8"

W	47-3/4"
H	23-3/4"
D	1-5/8"
L1	7/8"
L2	22"
L3	46"
L4	21"

Weight
14 lbs

AirQ Request Form

AirQ Report Request Form on page 48

AirQ Report Request Form

System Tag or ID		Job Name	
Date		Project Manager	

Contacts

Contact	Name	Telephone	Email	Comment
Representative				
Engineer				
Mechanical Contractor				
General Contractor				

Building Operational Characteristics

Zone Parameter	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10
Utility Rate										
Building Occupancy Hours										
Building Occupancy Days										
Exhaust Air Volume to Outside										
Supply Air Volume to Zone										
RA Volume from Zone to Air Cleaner										
Avg. IDU Fan Speed (% of high speed)										
Comments										

General Data

Zone Parameter	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10
Indoor-Unit Tag Number(s)										
Activity Type										
Area (Ft2)										
Average Ceiling Height (Ft)										
Average Occupancy										
Ventilation Air to Zone (CFM)										
Supply Air to Zone (CFM)										
Return Air from Zone (CFM)										
Exhaust Air from Zone* (CFM)										
Utility Rate										
Comments										

*Exhaust to building exterior. Supply air minus return air.

Air Cleaner and Indoor Unit Data

Zone Parameter	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10
LG Indoor Unit Model										
LG Indoor Unit Quantity										
Fan Mode (high or standard)										
4VL Air Cleaner Quantity										
2VL Air Cleaner Quantity										
Comments										

Baseline Air Filtering Plan*

Zone Parameter	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10
Filter Position #1										
Type										
Cost per Change										
Changes per Year										
Clean Filter SP Drop										
Dirty Filter SP Drop										
Comments										
Filter Position #2										
Type										
Cost per Change										
Changes per Year										
Clean Filter SP Drop										
Dirty Filter SP Drop										
Comments										
Filter Position #3										
Type										
Cost per Change										
Changes per Year										
Clean Filter SP Drop										
Dirty Filter SP Drop										
Comments										

*This table indicates the alternative filter plan if LG air cleaners are not used. AirQ software will generate a report comparing this system to the Dynamic V8 VL Series air cleaners.

Mechanical Specifications

Air Cleaners

ZFBXD201A and ZFBXD402A

- The air cleaners are manufactured by Dynamic Air Quality Solutions (www.DynamicAQS.com) and are supplied by LG Electronics USA Commercial Air Conditioning Division.
- The air cleaner uses advanced polarized media technology and is capable of removing ultra fine submicron particulate (0.1μm) and numerous gas-phase contaminants.
- Air cleaner media pads are engineered and supplied by the air cleaner manufacturer as an integrated design to maximize fit, finish, quality, and to nearly eliminate any leakage around the media and through the air cleaner housing.
- The air cleaner operates without generating any noise such as popping, or sparking noises typical of electrostatic air cleaner operation.

Housing

- The air cleaner housing is manufactured using 24-gauge hot-dip galvanized G90 steel.
- The air cleaner media is arranged in a deep V configuration. The 4VL (ZFBXD402A) standard height model has a minimum free area surface of 21ft^2 consisting of four media pads. The 2VL (ZFBXD201A) low profile air cleaner has a minimum of 10ft^2 and two media pads.
- All models of the air cleaner housing do not exceed 46” long and 23” wide and fit through an existing T-bar laying ceiling grid without having to remove any portion of the T-bar grid.
- The Air Cleaner is provided with a field mounted discharge-duct flange.

Housing Insulation

- All housing insulation is field provided and applied.
- No sound or thermal insulation is provided with the air cleaner.

Seals

- The housing seams are sealed with factory applied aluminum foil tape to minimize infiltration or exfiltration through the joints in the walls of the housing.
- Joints between the media pads and retaining frames, as well as the retaining frames and the filter housing are engineered to nearly eliminate all unfiltered air from bypassing the air cleaner media.
- All joint sealant materials are UL 823 listed.

Media Retainers

- Each media pad is held in place using a retaining system consisting of two expanded aluminum screens configured in a clamshell configuration.
- The leaving air end of the retaining frames are sealed together with an air-tight gasket to prevent bypass leakage.
- The media pads are easily removed from the clamshell frames without the use of tools.
- The leading edge of the media pad retainer frames are held together using a minimum of three, tool-less, latch type, quick release catches.
- The catches are engineered to allow maintenance access to two media pads simultaneously.

Media Pads

- Each media pad is a throwaway design consisting of a single sheet of material with no seams, cracks, or joints in the field of the media sheet.
- The media pad is manufactured as a multi-layer product consisting of fibrous polyolefin sheets and one conductive carbon sheet.
- The three layers are permanently bound together along all four edges and corners using a semi-ridged ribbed resin material that maintains the media's rectangular shape and prevents the sheet corners from rolling or folding.
- The semi-rigid ribbed resin media pad frame is securely sandwiched between two clamshell retainer frames.
- The ribbed resin frame perform as an airtight seal between the media pad and retaining frame.
- Any joints or cracks used to manufacture the ribbed resin pad frame are sealed using 3M Jet-melt™ sealant.

Controls

- Air cleaners come from the factory with a unit mounted control box on the right end.

  Note: By convention, the front is looking into the discharge, air blowing in the viewer's face.

- The air cleaner comes with a 208/60/1 to 24 VAC transformer sized to carry a minimum of two times the current draw of the air cleaners control circuit.
- Transformer is field mounted by the installer near the LG Multi V indoor unit disconnect.
- The air cleaner comes with 30 feet of low voltage wire and a quick connect plug on one end.
- The low voltage wire is field installed between the control power transformer and the air cleaner's unit mounted control panel.
- The air cleaner controls are powered at all times while the Multi V indoor unit disconnect is in the closed position.

- The air cleaner is designed to safely operate without air movement across the media.
- The clamshell media retaining system allowing access to the media pads cannot be opened without first removing the media-charge disconnect plate.
- The media charge disconnect consists of a removable plate that opens an end-switch inside the control panel. When removed, it shuts down power to the media pads.
- The media-charge disconnect plate is accessed from inside the optional return air plenum without accessing the building plenum or requiring the removal of ceiling tiles.
- A single tool-less thumbscrew removes the disconnect plate.
- A lanyard connected between the media-charge disconnect plate and air filter housing is provided to keep the plate from falling to the floor while servicing the unit.

Labeling

- The air cleaner model and serial number are readable from inside the plenum.
- A label is provided on the face of the disconnect plate, visible from inside the plenum, for the air balance technician to initially record the air cleaner TAG or ID number and the “clean” and “change media” air pressure drop (in-wg) specified by the design engineer.

Mounting Brackets

- The air cleaner is provided with four factory-mounted hanger brackets made of 1/8” galvanized hot-dipped steel designed to accept up to 1/2” field-provided all-thread hanger rods.
- Hanger brackets and mounting bolts connecting the bracket to the air cleaner are designed to properly support the weight of the air cleaner.
- Any field-provided connecting ductwork must be designed to be self supporting.

Seismic Restraints

- Hanger bracket and connecting bolts are engineered for installation in a seismic zone four.
- Seismic restraint cables, if needed, are sized and provided by the installer.

VRF Indoor Unit / Air Cleaner Compatibility

After subtracting the external static pressure reserved for consumption by field-provided duct and accessories, the media air pressure drop at the change media condition does not exceed the Indoor Unit fan’s external static pressure rating. The volume of air delivered from the IDU shall remain consistent with the cataloged values while operating in high mode on high speed over the life of the media.

ASHRAE 52.2-2007 without Polarization Test

General

The non-polarized air cleaner media has been tested by an independent third party testing facility using the single-pass ASHRAE 52.2-2007 test protocol using standard ASHRAE loading dust. The air cleaner was not powered during the test.

Performance

- Air Pressure Drop Efficiency: The clean media air pressure drop does not exceed 0.44 in-wg at 2,460 CFM.
- Dust Holding Capacity: The media loading capacity is 600 grams by weight at an air pressure drop of 1.4 in-wg.
- Minimum Efficiency Reporting Value (MERV) rating: 13 @ 1968 CFM.

ASHRAE 52.2-2007 with Polarization Test

General

The polarized air cleaner media has been tested by an independent third party testing facility using the single-pass ASHRAE 52.2-2007 test protocol using ASHRAE loading dust less the conductive carbon element. The air cleaner was powered during the test.

Performance

- Air Pressure Drop Efficiency: The clean media air pressure drop does not exceed 0.44 in-wg at 2,460 CFM.
- Dust Holding Capacity: The media dust loading capacity is 2,777 grams by weight at an air pressure drop of 1.4 in-wg.
- Non Conductive Minimum Efficiency Reporting Value (MERV-NC) rating: 15 @ 1968 CFM.

Particulate Removal — Multi-Pass Test to Equilibrium

General

The purpose of the multi-pass test was to measure the media's sustained performance under real world circumstances.

Because ASHRAE does not provide a test protocol of this nature, the test was conducted using an AHAM chamber (A chamber constructed to meet the specifications of the American Home Appliance Manufacturers). The basic test protocol followed ASHRAE 52.2-2007 but substituted 100% SAE Standard J726 test dust (fine) as the loading dust. The test dust was introduced to the chamber until the particle concentration rose to 60,000 particles per ft^3. No additional particulate was introduced to the chamber once the test began. The test continued for a minimum of 60 air changes or until the particulate concentration level reached equilibrium, whichever period was longer.

The airflow rate was set at 2000 CFM resulting in a cross-sectional face velocity of 500 feet per minute. The particle counter was calibrated to measure particulate that is 0.3 µm diameter, coinciding with the industry standard used when testing HEPA grade media.

Unlike the ASHRAE 52.2-2007 test, where the particle counter was placed directly upstream and downstream of the air cleaner media, the test protocol measured the airborne particle count in the middle of the chamber. Therefore, the calibrated particle counter was placed in the center of the chamber.

Performance

The Dynamic V8 media dropped the airborne concentration level of 0.3 µm size particulate from 60,000 particles per ft^3 to a sustained level of approximately 5,000 particles per ft^3 at 35 air changes.

Gas-Phase-Contaminant Removal in-Situ Test

General

The in-situ test measured the air cleaner's capability of removing airborne volatile organic compounds (VOCs) over time. Dynamic V8 media was installed in a hospital in northern-central region of the United States. The test protocol included mounting a calibrated Total Volatile Organic Compound (TVOC) meter upstream of the air cleaner and a second calibrated meter downstream. The test was conducted for a continuous 24-hour period. The concentration level of airborne VOCs was measured every three minutes during the testing period. Refer to "Table 6: In Situ Test – Hourly Measured VOC Concentration Levels" on page 39.

Performance

The upstream meter indicated rising and falling TVOC levels in the breathing zone for the 24-hour period. As time progressed, the amount of gas phase contaminants in circulation dropped. At eight hours and five minutes into the test the downstream meter indicated the air cleaner media was operating at 100% efficiency, removing all VOCs from the air stream. The downstream meter recorded no measurable VOCs (0.0 µg/m^3) for the remaining sixteen hours and twenty-two minutes of the test period. Refer to "Table 6: In Situ Test – Hourly Measured VOC Concentration Levels" on page 39 for the recorded levels at each hour of the test.

Return Air Plenums

ZPLMV201A and ZPLMV402A

- Optional ceiling-mounted return-air plenums and grilles that are engineered to directly connect with the Dynamic V8 VL Series air cleaner.
- The plenum housing is sized to allow air cleaner media pads to be removed and replaced through the bottom return-air grille without causing damage to the replacement media or removing any portion of the ceiling grid system or tiles.
- The plenum accessory is engineered to provide access to the air cleaner media pads without removing or damaging any portion of the ceiling grid system, including tiles grid and hangers.

Housing

- The plenum housing is manufactured using 22-gauge hot-dipped G90 galvanized steel.
- It is constructed with snap-lock seams and joints.
- The plenum ships knocked down for field assembly.
- The plenum housing is designed with the capability of serving up to two air cleaners. The plenum shall have a second discharge opening sized to accept the connection of a another VL Series air cleaner.
- A snap-lock filler panel is provided with all plenums for field installation to cover the second opening if not used.
- The plenum housing has pre-drilled holes on the leaving air opening(s) in a pattern that allows easy connection to the Dynamic V8 VL series air cleaner from inside the plenum without accessing the ceiling area.
- The plenum has four hanger brackets designed to support the weight of the housing and sized to accept up to 1/2” diameter field-provided all-thread rods.

Return Air Grilles

ZGRLRA01A and ZGRLRA02A

- Each plenum is provided with an accessory grille provided by LG Electronics.
- The grille is custom engineered to provide easy access to replace the air cleaner media from the conditioned space without accessing the ceiling plenum or removing ceiling tiles.
- The return-air grille and frame are a drop-in, near-flush-mount design that fits a standard 24” by 48” T-Bar ceiling grid system. Each grille may be securely fastened to the return air plenum using field provided #8 self-tapping zip screws through the grille frame.

Frame

- The grille frame is manufactured using extruded aluminum coated with a factory applied white baked enamel finish.
- The grille frame is equipped with a single hinged plenum access panel.
- The frame and grille opening are engineered to allow easy removal of the air-cleaner media pads without interference.
- The grille panels are held in the closed position with 1/2-turn tool-less catches.
- The grille panel hinges are not visible from the occupied space.

LG

Life's Good

Figures and Tables

Table of Figures

Table of Tables

LG
Life's Good

Appendix A: ASHRAE Standard 52.2-2007 Primer

Earlier Air Filtration Standards

The current ASHRAE Standard 52.2-2007 evolved out of the earlier 52.2-1999 and 52.1-1992 Standards. The earliest HVAC filtering was simply designed to reduce large-fiber fouling of heating and cooling coils in forced air systems. Most fine dust simply proceeded into the building, resulting in noticeable discoloring and fouling of interior surfaces, especially around supply registers. Over time, people have become more aware of health issues associated with air quality. These concerns led to the 52.1-1992 Standard, which introduced the arrestance and dust-spot efficiency tests.

Arrestance Test

The average ASHRAE arrestance test targets the coarser particles in airborne particulate matter. The test is performed by measuring the average weight of test dust before and after passing through a filter under a range of conditions. It is primarily used to measure dust that is capable of affecting equipment performance. Because of their relatively high particle removal efficiency, most modern filters used in commercial and industrial applications are rarely compared by their arrestance. Arrestance is used to test filter loading prior to other testing.

Dust Spot Efficiency Test

The dust spot efficiency test measures the finer particles in airborne particulate matter. More specifically, it measures a filter’s ability to reduce staining from atmospheric dust inside a building. It accomplishes this by measuring the passage of light of through two paper targets, one upstream of the filter and one downstream. Untreated air is passed through the two targets at a specified flow rate (CFM). At each flow rate, the static pressure drop across each target is recorded along with observing the level of light that passes through the targets. That is, the two targets are subject to set amounts and pressures of untreated outside air and then compared. A dust spot efficiency of 80% means the target that is upstream of the filter is 80% darker than the downstream target. It’s important to note that a dust spot efficiency percentage does not mean that percentage of test particles of a given size were captured by a filter.

Dust spot efficiency test ratings less than 20% are not considered worthwhile and are often omitted in favor of arrestance tests. The earliest furnace filters, had they been measured, would have produced ratings of around 10%. Dust spot efficiency test ratings over 98%, which are typical with HEPA filters, are also considered of limited usefulness, and such tests are frequently replaced by higher fidelity tests, such as the aerosol challenge test.

MERV Ratings (ASHRAE 52.2-2007)

MERV (Minimum Efficiency Reporting Value) rating testing methodology is defined in ASHRAE Standard 52.2. MERV provides a rating of a filter's performance across its entire life. The MERV rating for an air filter is based on a series of tests, ultimately resulting in a single MERV rating at a specified flow rate. ASHRAE Standard 52.2-2007 was a minor update to 52.2-1999 to adjust for inaccurate results from some coarse-fiber filters when testing with superfine particles.

ASHRAE Standard 52.2 tests use a compound test dust consisting of SAE fine dust, conductive carbon powder, and cotton linters. This compound is described as ASHRAE Loading Dust. The particles come in 12 discrete sizes ranging from 0.3 to 10µm in diameter. Each size represents one particle group. Each particle group in turn belongs to one of three efficiency groups, again based on a size range. The ranges are 0.3 to 1 µm, 1 to 3 µm, and 3 to 10 µm.

Note: A nitrogen atom, the most common component of air, is approximately 0.00164 µm in diameter. Under perfect laboratory conditions, ULPA filters arrest 99.999% of particles 0.12 µm and larger, and HEPA filters arrest 99.97% of particles 0.3 µm and larger. Both ULPA and HEPA are severely undermined as HVAC filters because they dramatically restrict airflow.

Test Procedure

A MERV test follows this procedure:

1. The clean filter is tested at set airflow rates to determine testing parameters.
2. A known number of particles from one particle group are logged and placed, as a group, into the pre-filter airstream.
3. The number of particles that make it to the post-filter airstream are counted and logged.
4. The loading and counting process is repeated five more times without replacing the filter, resulting in six measurements for each particle group for a total of 72 data points.
5. The worst result out of the six test results for each of the twelve particle groups is recorded, hence the minimum in Minimum Efficiency Rating Value (MERV).
6. The results from all the values in each efficiency group are averaged together, resulting in one value per group.
7. Each efficiency group value is divided by the total number of particles used for each test, resulting in a percentage value. That percentage is subtracted from 100, resulting in an efficiency percentage for each efficiency group.
8. The percentage is compared to the values in the table below, starting from the highest MERV value row and working down.
9. The first row where each of the three efficiency percentages meet or exceed the values in the table determines the MERV value. For example, the values 60% (0.3 to 1 µm), 79% (1 to 3 µm) , and 86% (3 to 10 µm) would result in a MERV 11 rating because that's the first row in the table that all three values meet or exceed the requirement in the table. That MERV 11 rating is roughly equivalent to a 60 to 65% dust spot efficiency rating.

MERV Air Velocity

All MERV ratings are at a stated air velocity. ASHRAE Standard 52.2 requires that tests are conducted at one of the following airflow rates:

- 118 FPM
- 246 FPM
- 295 FPM
- 374 FPM
- 492 FPM
- 630 FPM
- 748 FPM

MERV-NC and Conductive Loading Dust

ASHRAE Standard 52 requires the use of ASHRAE loading dust, which has a highly conductive carbon component, for determining a filter's MERV rating. Typical atmospheric dust is not conductive. Using conductive dust is of no consequence when testing conventional filters; however, employing conductive dust introduces serious inaccuracies when testing electrostatic and other active-field filter technologies. Therefore, when performing a completely compliant MERV test using ASHRAE loading dust on the Dynamic V8, the polarized media must be disabled.

Because ASHRAE loading dust is mandated by ASHRAE Standard 52.2-2007, DAQS cannot unilaterally modify the testing protocol to ensure a MERV value that more accurately reflects real-world performance. To indicate that we substitute a non-conductive dust for the carbon component of the ASHRAE loading dust but otherwise adhere to ASHRAE Standard 52.2-2007, we use the designation MERV-NC (non-conductive) to refer to the modified rating system.

Using the official testing protocol, the Dynamic V8 achieves an impressive MERV 13 rating, even when using conductive dust. The Dynamic V8 initially performs at MERV 16, drops to MERV 13, and ends at MERV 14. Because MERV (*Minimum* Efficiency Reporting Value) is based on the worst result, the end rating is MERV 13. Using non-conductive dust, the Dynamic V8 performs as designed with a final rating of MERV-NC 15.

A Real-World Test

In a typical real-world office environment the circulating dust is non-conductive. To demonstrate this and the superior performance of the Dynamic V8 in field conditions, a Dynamic V8 system was installed in a LEED®-rated office building in Atlanta Georgia four years ago. The subject systems employed a combination of variable-refrigerant-flow fan-coil indoor units and water-source heat pumps. Over the past four years, the air pressure drops across each air cleaner were recorded in real time. After four years of operation, the Dynamic V8 media had not reached the dirty filter condition and continues to remove particulate and gas-phase contaminants.

Table 7: MERV and Legacy Rating Characteristics

MERV	Particle Efficiency Group 0.3 to 1 µm	Particle Efficiency Group 1 to 3 µm	Particle Efficiency Group 3 to 10 µm	Average Arres-tance	Average Dust Spot Efficiency	Minimum Particle Sizes	Example Particulates	Example Applications	Typical Filters
1			< 20%	< 65%	< 20%	> 10 µm	Pollen, dust mites, sand-ing dust, textile fibers	Budget residential	Electrostatic filters, disposable panel filters, washable mesh filters
2			< 20%	65 to 70%	< 20%				
3			< 20%	70 to 75%	< 20%				
4			< 20%	75 to 80%	< 20%				
5			20 to 35%	80 to 85%	< 20%	3 to 10 µm	Mold, dust mite debris, cement dust, animal dander	Residential, commercial, industrial	Cartridge filters, high-end disposable panel filters, pleated panel filters
6			35 to 50%	85 to 90%	< 20%				
7			50 to 70%	> 90%	25 to 30%				
8			> 70%	> 90%	30 to 35%				
9		< 50%	> 85%	> 90%	40 to 45%	1 to 3 µm	Bacteria, lead dust, welding fumes, and auto emissions	Hospitals, residential, commercial	Bag filters, box filters, cartridge filters
10		50 to 65%	> 85%	> 95%	50 to 55%				
11		65 to 80%	> 85%	> 95%	60 to 65%				
12		> 80%	> 90%	> 95%	70 to 75%				
13	< 75%	> 90%	> 90%	> 98%	80 to 90%	0.3 to 1 µm	Bacteria, sneeze mist, cooking oils, most smoke (tobacco)	Operating rooms, smok-ing lounges, commercial	Dynamic V8 filters, bag filters, box filters
14	75 to 85%	> 90%	> 90%		90 to 95%				
15	85 to 95%	> 90%	> 90%		> 95%				
16	> 95%	> 95%	> 95%						
17*						< 0.3 µm	Viruses, carbon dust, sea salt, and some smoke	Manufacturing clean rooms	HEPA and ULPA filters (low air volume)
18*									
19*									
20*									

*Simulated MERV rating to include HEPA and ULPA filter ranges.

LG
Life's Good

Appendix B: ASHRAE Standard 62.2-2010 Primer

Introduction to ASHRAE Standard 62.1-2010

ASHRAE Standard 62.1-2010 is an excellent design resource for increasing the potential for acceptable indoor air quality within a building. The standard's procedures use educated assumptions to calculate the amount of outside air needed for each breathing zone. The standard has been adopted by numerous local code-enforcement agencies. The standard dictates the use of one of three methods for calculating minimum outdoor air volume:

- Ventilation Rate Procedure (Section 6.2)
- Indoor Air Quality (IAQ) Procedure (Section 6.3)
- Natural Ventilation Procedure (Section 6.4)

This section discusses the procedure for calculating outdoor air requirements for commercial buildings using the Ventilation Rate and IAQ procedures. The Natural Ventilation Procedure (that is, opening windows) is not discussed because the standard recognizes that procedure can easily produce conditions where IAQ drops below acceptable levels because the quantity of ventilation air cannot be controlled.

Unfortunately, the required calculations can become quite cumbersome and tedious for those designing systems with traditional variable-air-volume air handlers with terminal units and third-party controls integrators. Fortunately, the required calculations are much easier for those designing systems with LG VRF system in concert with dedicated outdoor air equipment. When using the Dynamic V8 air-cleaner system, Dynamic Air Quality Solutions will provide ASHRAE 62.1-2010 calculations for you, provide superior indoor air quality, lower the volume of required ventilation air, and reduce total cost of ownership for the building.

Important: This section is an overview of the standard. Please refer to the standard itself for details on designing to the standard. Important components of ensuring IAQ are addressed elsewhere in the standard and not here. For example, controlling internal moisture is critical to preventing biological growth with all its attendant problems. The standard also lists in section 2.9 reasons that acceptable IAQ might not be possible in some buildings regardless of the ventilation design.

Ventilation Rate Procedure (Section 6.2)

This procedure's calculations determine ventilation rates by considering the anticipated building occupants and the typical building materials used in modern day construction. Unusual air pollutants introduced to the breathing zone from outdoor air or from chemical use within the breathing zone are not considered. Refer to ASHRAE Standard 62.1-2010 for assistance when considering special situations requiring additional calculations.

Definitions

The procedure uses the following terminology:

Table 8: ASHRAE Standard 62.1-2010 Terminology

Term	Definition
Breathing zone	An area within a ventilation zone that is regularly occupied. The breathing zone is defined as the area 24” from walls and fixed air-conditioning equipment ranging from 3” to 72” off the finished floor.
Outdoor air	Outdoor ambient air that enters the building through infiltration and ventilation intakes.
Primary air	Air supplied to a ventilation zone prior to mixing it with any recirculated air as defined in addendum e to 62.1-2010.
Secondary air	Recirculated air that has not been mixed with primary air.
Ventilation	The process of adding or removing air from a space to control air temperature, humidity, and contaminants.
Ventilation zone	A discrete occupied space that requires ventilation. Zones can be defined by occupancy category, occupant density, outside air distribution effectiveness, or airflow rate per square foot. Infrequently occupied spaces, such as storage rooms, are not included.

Determining Ventilation-Air Volume (Section 6.2.1.1)

To determine the ventilation air volume:

1. Calculate the minimum volume of outdoor air required in each breathing zone (Vbz). To do so, you must determine the required minimum volume of outdoor air needed to offset pollutants emitted from building materials and people in the breathing zone:
   a. Calculate the floor area of the zone and the number of people that regularly occupy the zone. Use Table 6-1 in the Standard and lookup the people related (Rp) and area related (RA) minimum required outdoor air rates.
   b. Use the following equation to calculate the minimum outdoor airflow required for the breathing zone (Vbz). (Section 6.2.1.1):

   Vbz=(Rp*Pz)+(Ra*Az)

   Where:

   - Vbz = Breathing zone outdoor airflow
   - Rp = Minimum ventilation rate per person as defined in Table 6-1
   - Ra = Minimum ventilation rate per ft2 of floor area based on zone use as determined in Table 6-1

   Pz = Typical population for each zone

   Note: The equation considers only people and area related sources of pollutants. It does not imply that these are the only sources of pollutants that need to be addressed in the ventilation requirement for the zone. You may have to consider additional pollutants present in the breathing zone, such as stored chemicals, stage smoke effects, and combustion producing equipment.

c. Sum the breathing zone ventilation rates and apply a people diversity factor (if applicable). Using Table B-1 in the standard, lookup the special situation chemical or substance present in the ventilation zone and find the applicable concentration limit value(s). Verify the air exchange rate in the zone is adequate to reduce the concentration of the contaminant to the safe level.

2. Calculate the minimum required zone outdoor airflow (Voz) from Section 6.2.2.3. Use the formula:

   Voz = Vbz/Ez

   Where:

   - Voz = Minimum outdoor airflow rate delivered to the ventilation zone while the ventilation zones are occupied.
   - Vbz = Breathing zone outdoor airflow
   - Ez = Zone air distribution effectiveness

   (Ez) is a correction factor applied to the calculated value of Vbz. It adjusts the required volume of outside air to compensate for the laws of physics and placement of supply air grilles that impact proper distribution of outdoor air in the ventilation zone. These may include differential temperature between the ventilation zone primary airflow and the air currently in the ventilation zone and location of the supply register(s) in the ventilation zone. Section 6.2.2 lists various formula used to adjust the required amount of zone outdoor airflow (Voz) after distribution effectiveness (Ez) is considered.

   For example, if the zone outdoor airflow is colder than the air in the ventilation zone and is introduced to the zone from a register on the ceiling, then the zone outdoor airflow will readily sink to the floor and reach the breathing zone. In this case, the EZ factor will be 1.0 and no adjustment is needed because the zone outdoor airflow is readily distributed to the breathing zone.

   If the zone outdoor airflow is introduced to the same ventilation zone using the same register but the zone outdoor airflow is warmer than the air in the breathing zone, the zone outside airflow will tend to stick to or soon rise to the ceiling. In this case the EZ factor will be 0.80 and Voz will need to be adjusted up by 20%.

   If the outside air stream is introduced to the breathing zone in proximity to an exhaust or return-air grille, then a good portion of the zone outside airflow will be picked up by the exhaust or return grille and not distributed to the breathing zone at all. In this case, the Ez factor is 0.50 and an additional amount equal to 50% of the calculated zone outdoor airflow will be required to deliver the necessary volume of zone outside air to the breathing zone.

   See Table 6-2 in the Standard for a complete list of zone outdoor airflow distribution scenarios and their corresponding Ez factors.

3. Calculate the design system population (Ps) from Section 6.2.5.3.2. The design system population defines the largest peak population expected to occupy all the ventilation zones served by the outdoor intake during a typical occupied day. Because all zones may not be populated at the same time, this value will always be equal to or less than the sum of the design zone population for each zone.

4. Calculate the occupant diversity ratio (D) from Section 6.2.5.3.1. This factor accounts for anticipated movement of the population in the ventilation zone(s) served by one or more air handlers (the system):

   $D = Ps/\sum_{\text{all zones}} Pz$

   where:

   - Ps = Block number of people. When the ventilation zone is in use, this is the maximum anticipated block occupancy of all ventilation zones served by the IDU or air handler at any one moment in time during occupancy.
   - Pz = Peak number of people. When the ventilation zone is in use, this is the sum of the peak anticipated occupancy of each ventilation zone served by the IDU or air handler. If the peak population in a zone will vary, the designer is allowed to size the ventilation equipment based on the average population over time. Refer to section 6.2.6.2 for more information. If the maximum or average number of people is not known, use the default values listed in Table 6-1.

   Note: Alternative methods to account for occupant diversity are permitted, provided the resulting value for Vou is no less than that determined using this formula to determine “D”.

5. Calculate the Primary Outdoor Air Fraction (Zpz) from Section 6.2.5.1.

   $Zpz = Voz/Vpz$

   where:

   - Zpz = The primary outdoor air fraction. A fractional number (0-1.00) that indicates what portion of the primary airflow (Vpz) delivered to the ventilation zone originated from the outside air intake.
   - Voz = Minimum outdoor airflow rate delivered to the ventilation zone while the ventilation zones are occupied.
   - Vpz = Ventilation zone primary airflow. It is the rate of mixed air delivered to a ventilation zone comprised of outdoor air originating at the intake and delivered to the ventilation zone irrelevant of the IDU’s fan speed.

6. Calculate the Uncorrected Outdoor Air Intake (Vou) from Section 6.2.5.3

   $Vou = D\sum_{\text{all zones}}(Rp*Pz) + \sum_{\text{all zones}} Pz$

   where all variables are defined as above.

7. Determine the System Ventilation Efficiency (Ev). Among all the ventilation zones served by the outside air intake, find the one with the largest value for primary outdoor air fraction (Vpz). Use Table 6-3 or the Normative Appendix A in the Standard and use interpolation to determine the system ventilation efficiency (Ev).

8. Calculate the minimum outdoor intake airflow (Vot). Depending on the HVAC air-side system architecture, one of three equations will apply:

a. Decoupled 100% outdoor air equation: When one or more indoor units or air handlers supply only ventilation air drawn from the outdoor air intake and no mixing of secondary air (recirculated air) takes place and the air is delivered to one or multiple ventilation zones, then minimum outdoor intake airflow (Vot) is (from Section 6.2.4):

   where:

   - Vot = Minimum outdoor air intake airflow.
   - Voz = Minimum outdoor airflow rate delivered to the ventilation zone at all times while occupied.

b. Single-zone coupled outdoor air equation: One or more indoor units or air handlers supply mixed air comprised of outdoor air supplied from the outdoor air intake and secondary air (recirculated air) and delivers the air to a SINGLE ventilation zone, then the minimum outdoor intake airflow (Vot) is (from Section 6.2.3) Vot = Voz.

c. Multiple-zone coupled outdoor air equation: When one or more air handlers (the system) draw primary air (ventilation air) from the outside air intake, mix the outside air with secondary air (return air), and then deliver the mixed air to multiple ventilation zones, additional variables are then considered to calculate the minimum outdoor intake airflow (from Section 6.2.5.4):

   Vot = Vou/Ev

   where:

   - Vou = Uncorrected outdoor air intake
   - Ev = The system ventilation efficiency factor determined by knowing highest value for Zpz for all ventilation zones served by the indoor unit(s) or air handlers. Use Table 6-3 or the Normative Appendix A to determine Ev.

Indoor Air Quality (IAQ) Procedure (Section 6.3)

The easiest and most time effective method of calculating the true minimum outside air required to maintain a superior healthy and truly clean air inside the building. Please contact DAQS to have them perform this function for you. DAQS offers a guaranteed 48-hour turnaround time for determining the minimum ventilation air requirement calculations for your project. Call them at (609) 924-4489 to order an Air-Q Report. They will ask you to complete an Air-Q Request Form found on page 47.

Appendix C: DAQS Policies and Warranties

The Dynamic V8 is covered by the warranty and policies of Dynamic Air Quality Solutions (DAQS). The DAQS warranty and policies as of April 30th 2012 are listed verbatim below:

Return Policy

Requests to return new and unused products must be made within six weeks from date of purchase or eight weeks from the date of manufacture and should be directed to Heidi Birkland via email at hbirkland@DynamicAQS.com for a Return Authorization. Credits for returned goods are contingent upon inspection of the item(s) once received. A 15% restocking fee will be charged and the customer is responsible for freight. Non-standard sizes may only be returned if demand warrants. Do NOT return anything without a Return Authorization. All returned goods must have prior approval and be accompanied by a Return Authorization Number.

Dynamic V8 VL Series Limited Warranty

All Dynamic Products come with a Limited Warranty on parts. This Limited Warranty provides that a replacement part will be furnished at no charge for any part of the product which fails due to defects in material or manufacture while in normal use and service during the applicable Warranty period. Replacement parts are warranted for the unexpired portion of the original Warranty. The Effective Date of the Warranty will be the earlier of the date of installation or three (3) months from the date of manufacture. The Warranty Periods and any specific exclusions for various commercial products are as described below:

4VL and 2VL Series Polarized Media Electronic Air Cleaners are warranted for FIVE (5) YEARS after the Effective Date. Use of any replacement media other than that manufactured by Dynamic will void the warranty.

Control Panel and Control Boxes for the 4VL and 2VL Air Cleaners are warranted for a period of FIVE (5) YEARS after the Effective Date.

All other parts and assemblies including motors are warranted against defects in material and workmanship for a period of ONE (1) YEAR after the Effective Date.

Exclusions from this Warranty include damage or failure arising from: wear and tear; corrosion, erosion, deterioration; modifications made by others to the Products; repairs or alterations by a party other than Company that adversely affects the stability or reliability of the Products; vandalism; neglect; accident; adverse weather or environmental conditions; abuse or improper use; improper installation; commissioning by a party other than Company; unusual physical or electrical or mechanical stress; operation with any accessory, Products or part not specifically approved by Company; and/or lack of proper maintenance as recommended by Company. Nor does the Warranty cover any repairs other than those provided by an authorized services facility, nor does it cover labor or transportation costs that the Dealer may charge. Dynamic Air Quality Solutions is not responsible or liable for indirect, special, or consequential damages arising out of or in connection with the use or performance of the product or other damages with respect to any economic loss, loss of revenues or profit, or costs of removal, installation or reinstallation.

There may be charges rendered for shipping and repairs to the product made after the expiration of the aforesaid Warranty periods. Except as provided herein, Dynamic Air Quality Solutions makes no express or implied warranty of merchantability or fitness for a particular purpose. This Warranty gives specific legal rights and other rights may be available, which may vary from state to state.

Return-Air-Plenum Grille Limited Warranty

Manufacturer warrants that their products shall be free from defects in material or workmanship appearing within 30 days from the date of shipment. This warranty is contingent upon buyer giving seller prompt notice of any defect appearing within the prescribed 30 day time period. Manufacturer's obligation under this warranty is limited to the repair or replacement at its factory of any of the products which are defective in material or workmanship and which are returned to the seller with transportation charges prepaid and is conditioned upon the buyer furnishing satisfactory evidence that the products alleged to be defective have been properly installed, maintained, and operated under normal conditions. This warranty shall not apply to goods which have been subjected to misuse, abuse, neglect or improper storage, handling or maintenance.

Warranty Procedures for Commercial Products

This information is provided as a guide regarding warranty claim procedures for Dynamic Air Quality Solutions commercial indoor air quality products.

1. Determine model number from the label on the unit.
2. For technical support, warranty information, warranty parts or replacement parts, contact Dynamic Air Quality Solutions, toll-free M-F, 9:00 AM-5:00 PM ET at (800) 578-7873. A Dynamic representative will help you troubleshoot and diagnose the problem. Warranty matters involving products sold through a manufacturer representative should be directed to the appropriate representative.
3. If the part is found to be defective, Dynamic will ship a new replacement part, freight prepaid, along with a Return Authorization / Return Label or envelope, if Dynamic wants the part returned.
4. Important: Do NOT return anything without a Return Authorization.
5. All returned parts are quality tested. If the returned part is found not to be defective, you may be invoiced for the new part and shipping costs.

LG

Life's Good

Acronym List

APD	Air Pressure Drop	in wg	Pressure Measured in inches of Water
AHAM	American Home Appliance Manufacturers	LEED	Leadership in Energy and Environmental Design
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning	MERV	Minimum Efficiency Reporting Value
CAC	Commercial Air Conditioning	MERV-NC	Minimum Efficiency Reporting Value-Non Conductive
CFM	Volume in Cubic Feet per Minute	PD	Pressure Drop
DAQS	Dynamic Air Quality Solutions	PTAC	Packaged Terminal Air Conditioner
DOAS	Dedicated Outdoor Air System	RA	Return Air
EDL	Engineering Dynamics, Ltd.	SAE	Society of Automotive Engineers
FPM	Velocity in Feet per Minute	TVOC	Total Volatile Organic Chemicals
HEPA	High Efficiency Particulate Air	UL	Underwriters Laboratories
HVAC	Heating, Ventilating and Air Conditioning	VAC	Volts AC
IAQ	Indoor Air Quality	VOC	Volatile Organic Chemical
IDU	Indoor Unit	VRF	Variable Refrigerant Flow

LG
Life's Good

LG Electronics
Commercial Air Conditioning Division
11405 Old Roswell Road
Alpharetta, Georgia 30009
www.lg-vrf.com

Dynamic Air Quality Solutions Support
1-800-578-7873 USA
9 AM - 5 PM
Monday - Friday

VRF-IM-DS-001-US 013C26