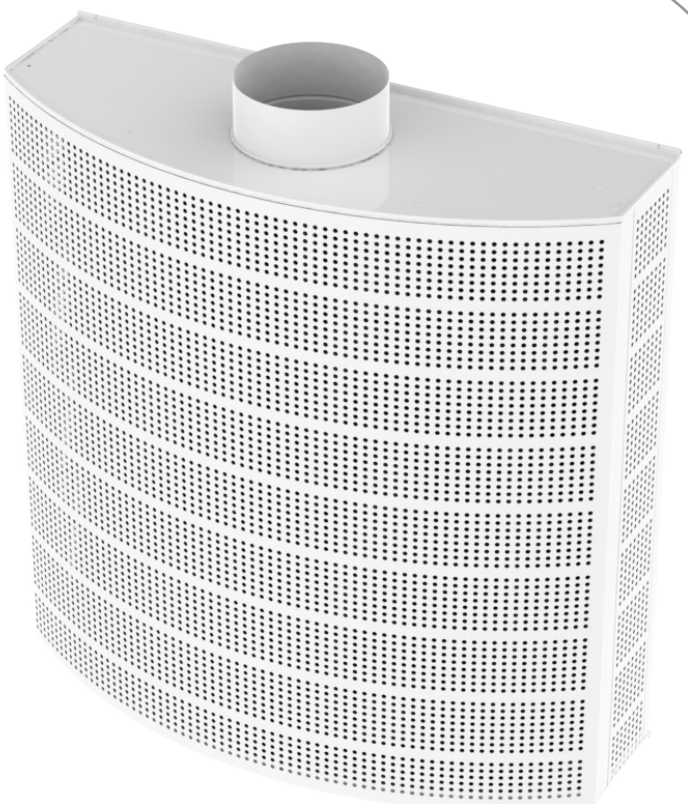
Titus
Redefine your comfort zone.™

displacement ventilation

light powered | dual-function | smart logic | woodgrains | energy solutions

T



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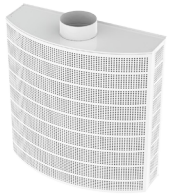
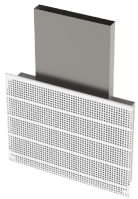
rectangular displacement



DVBC

WALL MOUNT APPLICATIONS

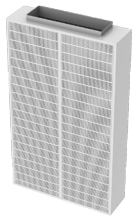
- 3-way air discharge pattern
- Supplies a large amount of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat



DVIR

FLUSH MOUNT APPLICATIONS

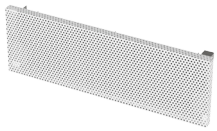
- 1-way discharge air pattern
- Supplies small to medium amounts of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment



DVRI

FLUSH OR SURFACE MOUNT APPLICATIONS

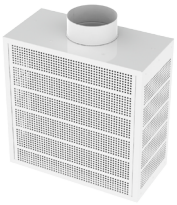
- 1-way air discharge pattern
- Supplies a large amount of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat



DVR1

FLUSH OR SURFACE MOUNT APPLICATIONS

- 1-way air discharge pattern
- Supplies small to medium amounts of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat



DVR3

WALL MOUNT APPLICATIONS

- 3-way air discharge pattern
- Supplies a large amount of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat

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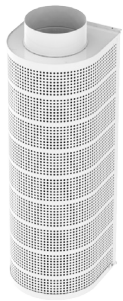
semi-circular displacement

DV180

WALL OR SURFACE MOUNT APPLICATIONS

- 180° air discharge pattern
- Supplies a large amount of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat



DVHC

WALL OR SURFACE MOUNT APPLICATIONS

- 180° air discharge pattern
- Supplies a large amount of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat

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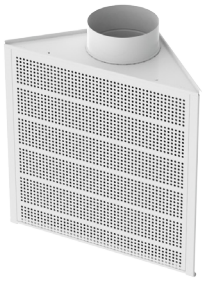
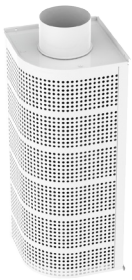
corner mount displacement



DVC1

CORNER MOUNT APPLICATIONS

- 90° air discharge pattern
- Supplies a large amount of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat



DVVC

CORNER MOUNT APPLICATIONS

- 90° air discharge pattern
- Supplies a large amount of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat

circular displacement

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DVCP

FLOOR APPLICATIONS

- 360° air discharge pattern
- Supplies a large amount of air at low velocity into the occupied zone
- Enhanced pattern controllers for easy adjustment
- Standard finish is #26 white powdercoat

heating & cooling options

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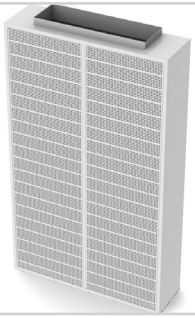
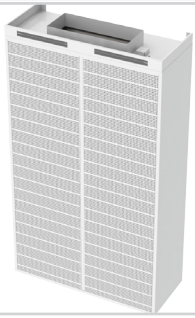


DVRI-HC 14 / DVRI-HC 32

WALL OR SURFACE MOUNT APPLICATIONS

- Dual function diffuser for cooling and heating
- Top section - Displacement cooling
- Bottom section - mixed airflow heating
- Standard finish is #26 white powdercoat



DVRI-HCS

WALL OR SURFACE MOUNT APPLICATIONS

- Ambient light powered
- Energy savings
- Dual function diffuser for cooling and heating
- Top section - Displacement cooling
- Bottom section - mixed airflow heating
- Standard finish is #26 white powdercoat

Overview

Displacement Ventilation systems use low velocity cold air to displace warm room air. They are defined by ASHRAE as fully stratified systems. Supply air is introduced low in the occupied space and travels along the floor until it reaches a heat source, such as a person or computer. Natural convection flows cause the supply air to rise around the heat source.

The Displacement Ventilation system is similar to an UnderFloor Air Distribution (UFAD) system in that is uses warmer supply air and lower pressures then a conventional overhead system. As a result, displacement ventilation systems have many of the same benefits of UFAD systems, such as longer economizer periods, potential energy savings from the warmer supply air and lower horsepower fans, and quiet operation. Although many parts of North America need to cool the supply air below 65°F for humidity reasons, all areas should benefit from the increased economizer time.

An additional benefit to Displacement Ventilation systems is that ASHRAE Standard 62.1-2007 Ventilation for Acceptable Indoor Air Quality gives Displacement Ventilation systems a Ventilation Effectiveness Factor of 1.2. Ventilation Effectiveness is a measure of how effectively the zone air distribution uses its supply air to maintain acceptable air quality in the breathing zone. A Ventilation Effectiveness of 1.2 means that a lower volume of fresh air can be used to meet ASHRAE 62.1 requirements. This makes displacement ventilation systems an effective way to achieve the LEED Increased Ventilation credit.

One of the challenges to displacement ventilation is that the diffusers are placed in the occupied zone, typically along the wall. Because displacement diffusers supply air directly into the room, placement of occupants is critical to achieving a comfortable space. The ASHRAE Guideline recommends that the air velocity in the occupied space not exceed 50 fpm. For a displacement diffuser, the zone where the velocity exceeds 50 fpm is called the adjacent zone or near zone. Occupants need to be placed outside of the adjacent zone for comfort. A typical displacement diffuser can maintain comfort in a space that is 5-6 times the length of the adjacent zone.

Titus has a full line of displacement ventilation diffusers to accommodate any application. One unique and specifiable feature of Titus displacement diffusers is the variable air pattern controllers located behind the perforated face. The pattern controllers can be adjusted to change the size and direction of the supply air isovel and adjacent zone area. Engineers may not always know the final room layout or furniture location during the design phase. Titus displacement diffusers provide the perfect solution by offering adjustability without the need to move or change the location of the diffuser. This ability to shape and customize the airflow pattern and adjacent zone to match requirements in the occupied space ensures the highest level of thermal comfort for building occupants.

APPLICATION ICONS KEY

energy solutions	contributes toward energy savings by reducing operating costs of air distribution devices
smart logic	unit contains smart logic mechanism enabling it to adjust the temperature band between heating & cooling
dual-function	supplies both heating & cooling from one HVAC device. Saves installation costs due to no requirement for a secondary system
light powered	energy-harvesting & savings feature of an HVAC device powered by ambient light
woodgrains	additional finish options available for HVAC products that resemble realistic woodgrains, and adds high-end detail quality to any application

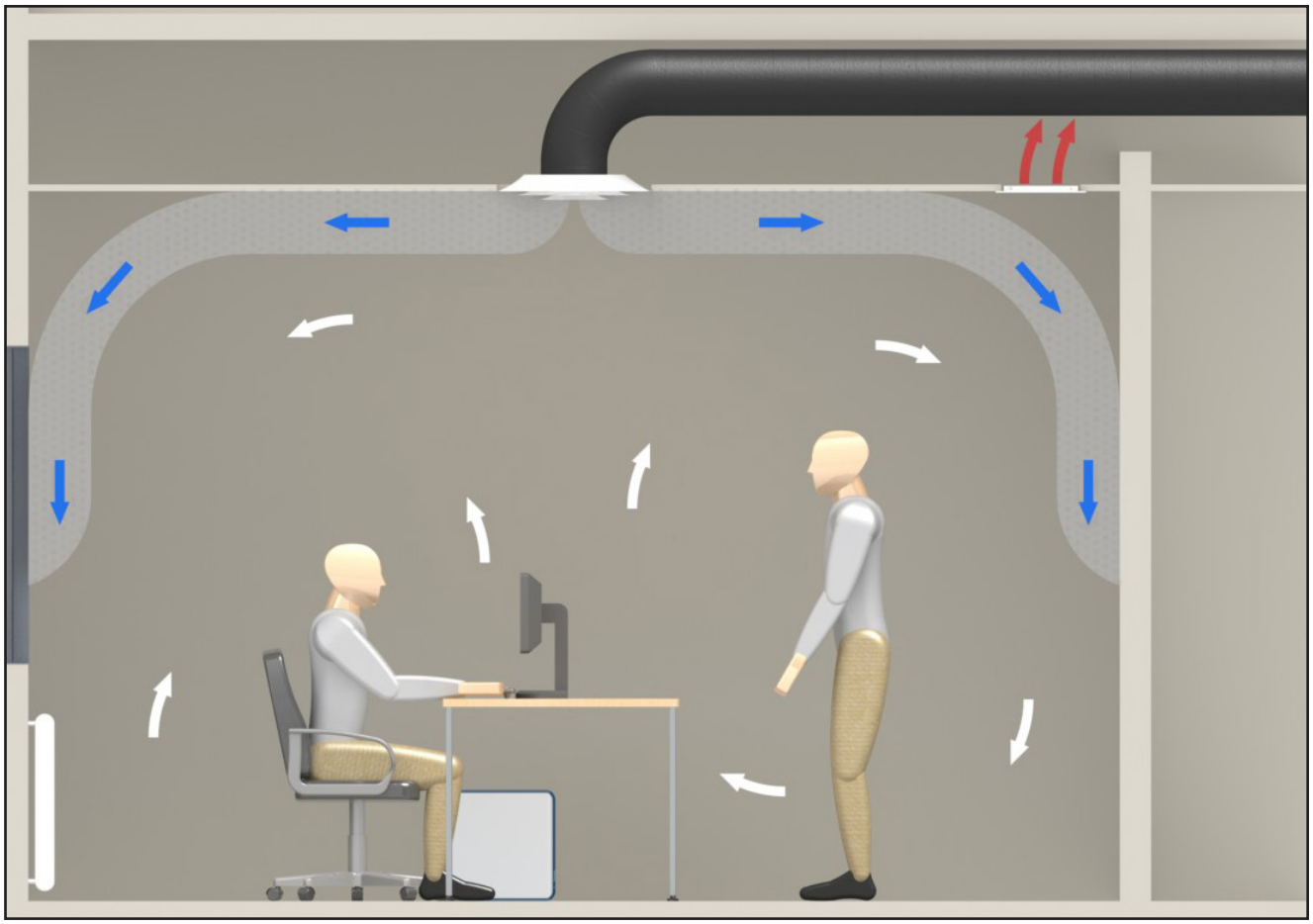


Figure 1. Mixed Air System

Displacement Ventilation Design & Application Guide

Buildings come in all shapes and sizes and are designed for any number of purposes. In order to create healthy and productive environments, air distribution systems must be selected that best meet the goals of designers. There are a wide range of choices available, but often one system can be identified as the best solution in terms of cost, comfort and energy. The purpose of this guide is to explain how displacement ventilation works, describe recommended applications and provide engineering guidance to the system designer.

INTRODUCTION TO DISPLACEMENT VENTILATION

In order to understand the advantages and limitations of displacement ventilation, it's important to understand the differences between conventional mixed air distribution and fully-stratified air distribution.

In mixed air distribution, hot or cold supply air is delivered at relatively high velocity from ceiling-mounted diffusers. When ceiling diffusers are properly selected and positioned, this high velocity air doesn't result in occupant discomfort because it is delivered outside the occupied zone. The purpose of the high velocity supply is to create low velocity room air motion through entrainment. Ideally, this air motion will thoroughly mix the supply air with the room air resulting in uniform temperature

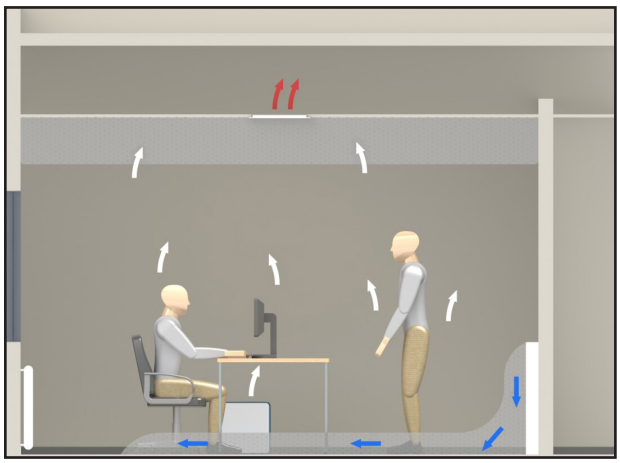


Figure 2. Fully-Stratified System

and contaminant levels throughout the occupied zone. Internal heat loads and contaminants are eventually picked up and carried away by the return air.

In fully-stratified air distribution, cool supply air is typically delivered at reduced velocity from low sidewall diffusers. The supply air is always cooler than the room air, so it quickly drops to the floor and moves slowly across the room. When this slow moving air mass encounters a heat load, it rises and carries the heat and pollutants towards the ceiling. A layer

of warm air forms above the occupied zone due to natural buoyancy. Internal heat loads and contaminants are carried away by the return air.

The main differences between these systems are:

Mixed air distribution
- Suitable for both heating and cooling with a supply temperature range of 38 to 90°F
- Air is supplied to the unoccupied zone at relatively high velocity
- Minimizes temperature variations throughout the space
- Creates uniform contaminant concentration throughout the zone

Fully-stratified air distribution
- Suitable for cooling only with a supply temperature range of 62 to 70°F
- Air is supplied directly to the occupied zone at low velocity
- Takes advantage of natural air buoyancy to divide the zone into two regions
- Heat and pollutants rise into the upper unoccupied zone
- Contaminant concentration is greatly reduced in the lower occupied zone

AIR CHANGE EFFECTIVENESS

ASHRAE Standard 62.1-2010 'Ventilation for Acceptable Indoor Air Quality' assigns a zone air distribution effectiveness value (E_z) of 1.0 for conventional mixed air systems and 1.2 for fully-stratified systems (Table 6-2). This means that fully-stratified systems are 20% more effective than the best mixed air systems and can provide the same level of ventilation with a 16.7% reduction in air volume. This reduces the amount of outdoor air necessary to meet ventilation requirements.

TYPICAL APPLICATIONS

Ideal applications for displacement ventilation often involve large open spaces with tall ceilings. These include but are not limited to:
- Theaters and performance halls
- Meeting rooms and lecture halls
- Restaurants and cafeterias
- Hotel lobbies and atriums
- Shopping malls
- Gymnasiums
- Casinos
- Museums and exhibit halls
- Classrooms
- Airport terminals and train stations

CONTAMINANT REMOVAL

Displacement ventilation can be a very effective strategy for removing contaminants from room air, because fully-stratified systems take advantage of the fact that airborne pollutants are generally lighter than air. The natural buoyancy of tobacco smoke and human respiration allow these pollutants to rise above the breathing zone in plumes to the upper zone that forms below the ceiling. This upward migration of pollutants effectively increases concentrations in the unoccupied upper zone while reducing concentrations in the breathing zone.

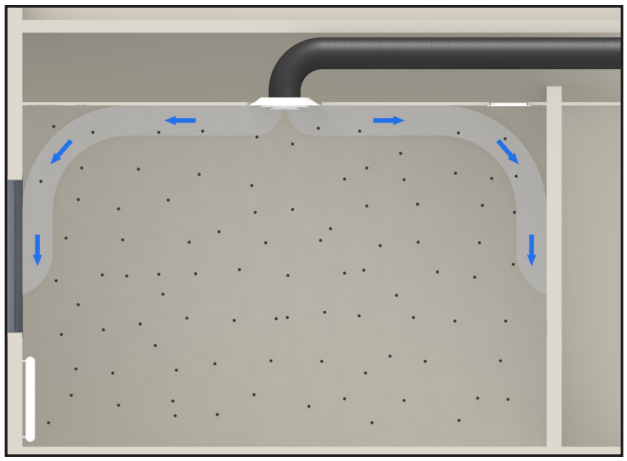


Figure 3. Contaminant Distribution in a Mixed Air System

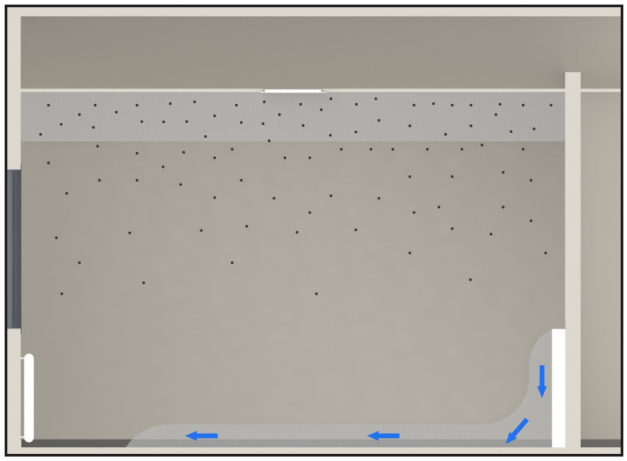


Figure 4. Contaminant Distribution in a Fully-Stratified System

A couple of important considerations:
- Displacement ventilation is not recommended for spaces where hazardous chemical spills could occur. In the event of a spill, a displacement ventilation system is likely to cause noxious fumes to be drawn from the floor and brought up to the breathing level, thereby increasing the possible hazard to occupants
- In rare situations where contaminants are heavier than air, accommodations should be made to allow some portion of the room air to be extracted at a lower level

BENEFITS AND LIMITATIONS

Typical benefits of displacement ventilation include:
- Improved removal of airborne contaminants
- Greatly reduced energy requirements to cool occupied spaces in mild climates
- Reduced ventilation air requirement due to increased air distribution effectiveness
- Very low diffuser noise levels
- Reduced comfort complaints due to drafts

Although displacement ventilation is well-suited for a wide variety of applications, the following spaces may be better served by mixed air systems:

- Spaces with ceiling heights lower than 9 ft
- Spaces with occupied zone heat loads in excess of 30 Btu/hr-ft^2
- Spaces furnished with cubicles or other partitions
- Spaces with ceiling heights lower than 10 ft that may be subject to significant room air disturbances
- Applications involving contaminants that are heavier and/or colder than room air in the occupied zone

ENERGY CONSIDERATIONS

Displacement ventilation can reduce energy use in several ways:

- Increased economizer hours due to increased supply temperatures in comparison to conventional mixed air systems
- Chiller efficiency increases due to lesser dehumidification at higher water supply temperatures

OUTLET CHARACTERISTICS

Displacement ventilation requires outlets that supply air at extremely low velocities, (typically 50-70 fpm). These outlets are typically located low on a sidewall or at the base of a column. The low average face velocity generally results in rather large diffuser panels. Since the outlets are located adjacent to the occupied zone and within easy reach of room occupants, they have the following special requirements:

- Should be elevated above the floor to prevent damage from cleaning equipment
- Construction and finishes must be rugged enough to prevent damage through accidental or intentional occupant contact
- Should provide a concealed and tamperproof means of air pattern adjustment
- Face panel must be removable for cleaning and adjustment of air pattern controllers

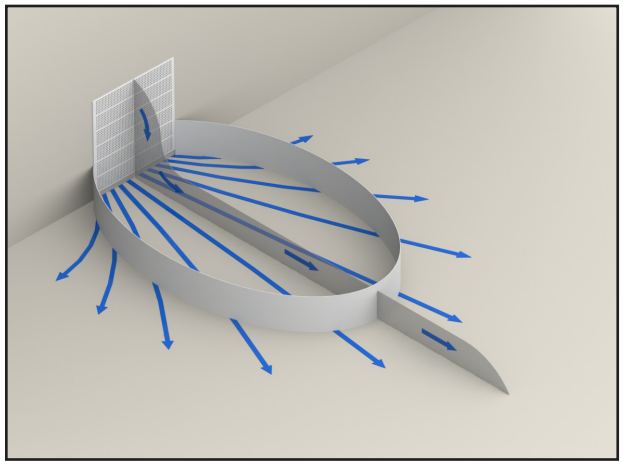


Figure 5. The Adjacent Zone

THE ADJACENT ZONE

The area immediately adjacent to a displacement ventilation outlet is known as 'the adjacent zone'. This is any area in the occupied zone where local air velocities exceed 50 fpm at a height 1" above the floor. Although this clear zone can often be in an aisle or corridor without creating potential comfort problems, stationary occupants should never be located within the adjacent zone. Cool air that drops from a sidewall diffuser and travels across the floor can easily be sensed by stationary occupants at the ankle level.

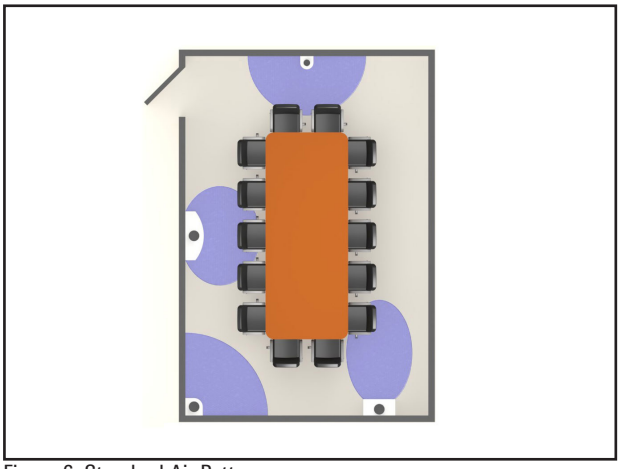


Figure 6. Standard Air Patterns

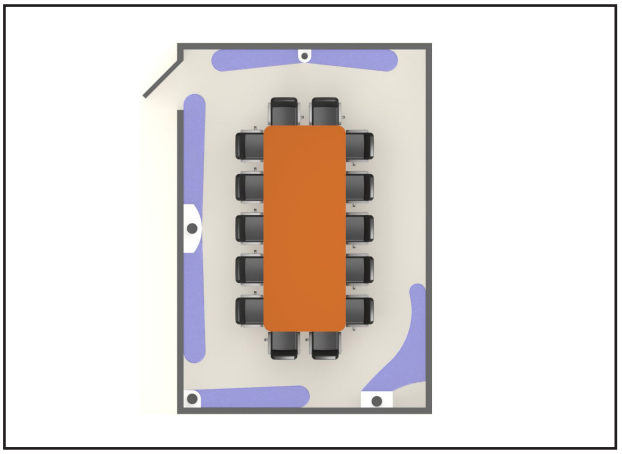


Figure 7. Adjusted Air Patterns

It is important to note that all Titus displacement ventilation diffusers are supplied with adjustable air pattern controllers as standard equipment. The ability to adjust the shape of the air pattern and the adjacent zone can be of great benefit when dealing with furniture, occupants and obstructions especially in smaller spaces.

OUTLET CHOICES

Displacement ventilation diffusers are available in a wide range of styles and sizes. Unlike conventional ceiling diffusers, the size and placement of displacement ventilation diffusers require early coordination with architectural professionals for successful project integration. Generally speaking, displacement diffusers can be ducted from above or below or plenum-supplied.

All Titus displacement diffusers include:

- Adjustable air pattern controllers
- Air balancing tap
- Removable face plate
- All metal construction (galvanized steel and aluminum)
- Standard #26 white powdercoat finish
- Optional telescoping duct cover (not applicable to DVR1)
- Optional 2-$^3/_4$ or 4 inch mounting base (not applicable to DVR1)

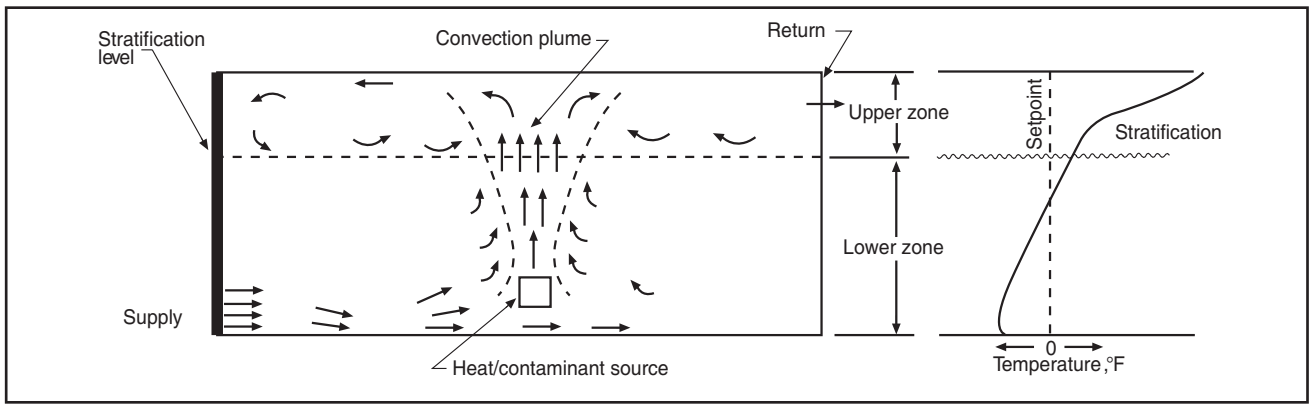


Figure 8. Heat Plume

HEAT SOURCES AND CONVECTIVE FLOWS

The flow of convective heat is essential in establishing a fully-stratified system. As heat moves from warmer surfaces to the cooler surrounding air, the buoyancy of the air increases and the heat rises to create stratification in the occupied zone. This upward air motion driven by convection also results in room air entrainment that results in a larger heat plume. Although radiant heat sources do not directly affect these convective heat plumes, they may increase plume formation by increasing surface temperatures of heat sources.

The characteristics of individual convective heat plumes may be influenced by each of the following:

- Size and shape of heat source
- Amount of heat available
- Air motion surrounding heat source
- Temperature gradient in the space

Convective heat plumes will continue to rise until they reach a room level of equal temperature.

SPACE TEMPERATURE GRADIENTS AND AIRFLOW RATES

Displacement ventilation diffusers supply conditioned air at higher cooling temperatures (typically 62 to 70°F) and lower discharge velocities (less than 70 fpm) than ceiling diffusers. Since the supply air is always cooler than the room air, it can be said to cascade from the diffuser face to the floor. The negative buoyancy of the cooler air causes it to move at the floor level until it reaches a source of convective heat. As the supply air warms, its buoyancy increases to create a heat plume that rises to the upper mixed zone below the ceiling.

The distance from the floor to the upper mixed zone is known as the shift height. Since the design goal of a displacement ventilation system is to create temperature stratification throughout the occupied zone, it is critical that the shift height is greater than height of the occupied zone. Lower shift heights may be acceptable in situations where all occupants are seated.

AIR PATTERN PROJECTION

Although displacement ventilation is typically supplied from a low sidewall, the resulting room pattern is very different from a conventional sidewall grille. Because the supply air is cooler than the room air and is discharging at low velocity, it immediately drops to the floor. The air moves across the floor in a thin layer typically no more than 6-8 inches high. The diagrams above show why displacement ventilation is only recommended for cooling applications.

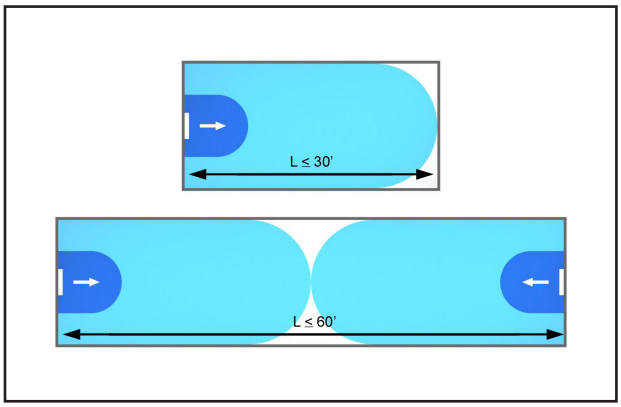


Figure 9. Discharge Air Patterns

This air pattern tends to stretch out and cover the entire room, even if the room shape is irregular. Obstructions such as partitions or furniture resting directly on the floor can result in coverage gaps, but the air pattern will rejoin itself much like fluid passing around an object.

Displacement diffusers can typically provide coverage into a room that is up to six times the length of the adjacent zone. Internal heat load concentrations actually help to extend the projection of a displacement system by drawing the air across the room. Large rooms can be supplied from the side walls so long as the distance from the diffuser face to the furthest projection is no more than 30 ft. When room dimensions exceed 30 ft in length or width, it is best to place displacement diffusers on more than one wall. By placing diffusers on opposing walls, rooms up to 60 ft can be supplied from side walls. Another solution for large rooms is to place 360-degree diffusers throughout the interior space.

METHODS OF EVALUATION

A successful displacement ventilation design should provide a supply airflow rate to meet the thermal gradient profile of an occupied space in accordance with ASHRAE comfort guidelines. ASHRAE Standard 55-2010 'Thermal Environmental Conditions for Human Occupancy' recommends that vertical temperature differential between a seated occupant's ankle and head regions (roughly 4 to 43 in) should be no more than 5.4°F to deliver acceptable comfort to 95% or more of the occupants. For a stationary standing person same guideline would apply over an elevation range of 4 to 67 in.

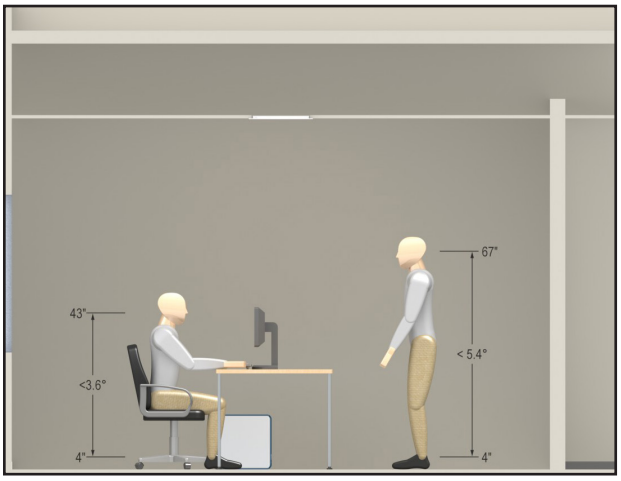


Figure 10. Maximum Temperature Differentials for Acceptable Thermal Comfort

SUPPLY AIR CONNECTIONS

Displacement ventilation diffusers are usually supplied by ductwork and they can be supplied from either above or below.

- Optional telescoping duct covers are available to hide otherwise visible supply ductwork for a clean finished appearance
- Optional mounting bases (2-3/4 or 4 inch) are recommended to prevent possible damage due to traffic and floor cleaning equipment. These mounting bases are also recommended to simplify installation when air will be supplied from below.

It is also possible to supply displacement ventilation diffusers from a pressurized plenum.

- Care must be taken to insure that the supply plenum is tightly sealed
- In a properly designed supply plenum, pressures should be equal throughout and balancing dampers should not be required

ACOUSTICAL PERFORMANCE

Like any building space, those supplied by displacement ventilation create an acoustical environment with contributions from air handlers, terminal units, diffusers and structure-borne sound. Properly sized and selected displacement ventilation diffusers are rarely the cause of noise complaints because they operate at low pressure and low velocity and therefore do not generate audible noise. The catalog sound performance rating of a displacement diffuser is usually expressed in terms of a noise criteria (NC) level based upon a typical space with room absorption of 10 dB in each octave band per ASHRAE Standard 70-2006 (Appendix D).

While this typical space effect has been used for many years to estimate the sound level of a diffuser serving a small office, this certainly isn't the typical environment in which displacement ventilation is employed. Since we are often dealing with much larger spaces and taller ceilings, a different method must be employed to better estimate sound levels. A space effect for each octave band can be calculated based upon the size of the room and the distance between the source and observer using the following equation per AHRI Standard 885-2008:

Space Effect = 25 – 10 log (ft) – 5 log (ft^3) – 3 log (Hz)

Where:

ft = Distance between the source and observer
ft^3 = Room volume
Hz = Octave band center frequency

When considering sound contributions from multiple diffusers, we can logarithmically add or multiply, but this is typically unnecessary. In large spaces, diffusers are rarely close enough together to contribute to the overall room sound level. As a general rule for smaller spaces, it is advisable to select diffusers for an NC level that is 10 points lower than the desired room sound level. This has the effect of masking the sound contribution of the diffusers in the background sound level. For larger spaces, the NC level of the diffuser is less critical because the room effect is so much greater.

DISPLACEMENT VENTILATION THEORY AND GOVERNING EQUATIONS

The following material is based on ASHRAE research project RP-949 that resulted in the ASHRAE publication 'System Performance Evaluation and Design Guidelines for Displacement Ventilation' (2003). This summary is intended to briefly explain the theory behind displacement ventilation. For a more detailed explanation including the derivation of each equation, the original publication is highly recommended.

The design air volume supplied by a displacement ventilation system must be capable of meeting both the cooling and minimum ventilation requirements for a given space. In order to determine the cooling design air volume, the type, location and magnitude of all heat loads must be identified. These loads can be classified as:

- Heat generated by occupants, desk lamps and office equipment, Q_{oe} (Btu/h)
- Heat generated by overhead lighting, Q_l (Btu/h)
- Heat from the exterior wall and window surfaces including transmitted solar radiation, Q_{ex} (Btu/h)

A weighting factor must be applied to each of these loads to properly approximate the effect of each type of load entering the region between the head and the feet of a seated occupant. Based on ASHRAE research, these weighting factors are:

- Occupants, desk lamps and office equipment, $a_{oe} = 0.295$
- Overhead lighting, $a_l = 0.132$
- Exterior wall and window surfaces including transmitted solar radiation, $a_{ex} = 0.185$

The heat transfer to the region of interest can therefore be calculated by the following equation:

$$\Delta T_{hf} \rho C_p V = a_{oe} Q_{oe} + a_l Q_l + a_{ex} Q_{ex}$$

Where:

- ΔT_{hf} = temperature differential between the head and foot level of occupant (°F)
- ρ = air density under standard conditions (lb/ft^3)
- C_p = specific heat of air at constant pressure (Btu/lb-°F)
- V = supply flow rate (ft^3/h)

Since:

$$V = nHA$$

Where:

- n = the required air change rate (ach)
- H = space height (ft)
- A = floor area (ft^2)

The heat transfer equation can be simplified to:

$$\Delta T_{hf} = (a_{oe}Q_{oe} + a_lQ_l + a_{ex}Q_{ex}) / (\rho C_p nHA)$$

ASHRAE Standard 55-2010 recommends that for good thermal comfort the temperature difference between the head and foot level of a standing person should not exceed 5.4°F. In a stratification zone, assume that the temperature gradient will be less than 1°F/ft. Since the vertical temperature gradient between a seated person's head (3.6 ft) and a standing person's head (5.6 ft) is generally less than that between the ankle level (0.3 ft) and seated person's head (3.6 ft), any design that meets the seated recommendations should also be suitable for a standing person.

The same equation can be used to calculate the required ventilation rate:

$$n = (a_{oe}Q_{oe} + a_lQ_l + a_{ex}Q_{ex}) / (\Delta T_{hf}\rho C_p HA)$$

The cooling air volume (cfm), V_h, for a typical office environment can then be calculated using the following equation:

$$V_h = nAH/60$$

Substituting the ventilation rate, n, into the equation yields:

$$V_h = (0.295Q_{oe} + 0.132Q_l + 0.185Q_{ex})/(\Delta T_{hf}\rho C_p)$$

With the following assumptions:

- ΔT_{hf} = 3.6 °F (for a seated occupant)
- ρ = 0.075 lb/ft^2
- C_p = 0.24 Btu/lb-°F

This equation can be simplified to:

$$V_h = 0.076Q_{oe} + 0.034Q_l + 0.048Q_{ex}$$

This equation is very useful for typical applications involving seated occupants.

The required ventilation rate can be determined by consulting ASHRAE Standard 62.1-2010. This standard provides recommended ventilation rates for various room occupancies and applications (Table 6-1). These recommendations involve the minimum ventilation rates in the breathing zone based upon both occupant density and floor area.

The breathing zone outdoor airflow (cfm), V_{bz}, can be calculated using the following equation:

$$V_{bz} = (R_p \text{ x } P_z) + (R_a \text{ x } A_z)$$

Where:

- R_p = people outdoor air rate from Table 6-1 (cfm/person)
- P_z = zone population (#)
- R_a = area outdoor air rate from Table 6-1 (cfm/ft^2)
- A_z = zone floor area (ft^2)

ASHRAE Standard 62.1-2010 also defines air change effectiveness (E_z) of various types of air distribution systems (Table 6-2). While the best mixed air system with ceiling diffusers can only achieve a rating of 1.0, displacement ventilation systems achieve a 1.2 rating. This means that a displacement ventilation system can meet ventilation requirements with 16.7% less air volume than a mixed air system. Be aware that local code requirements may be more stringent than the minimum standards recommended by ASHRAE and may not differentiate between system types and air change effectiveness.

The zone outdoor airflow requirement (cfm), V_{oz}, can be calculated as:

$$V_{oz} = V_{bz} / E_z$$

Where:

- E_z = air change effectiveness from Table 6-2

The supply air volume (cfm), V, will be larger of either the cooling air volume (cfm), V_h, or the zone outdoor airflow requirement (cfm), V_{oz}. Be aware that if a dedicated outdoor air system (DOAS) is employed, then supply air volume, V, would consist of 100% outdoor air. If return air is being mixed with outdoor air, supply air volume, V, must contain enough outdoor air to meet the zone outdoor requirement, V_{oz}.

The supply air temperature, T_s, is always cooler than the room temperature, T_{sp}, and can be calculated by based on the air temperature at the floor level, T_f.

$$T_f = T_{sp} - \Delta T_{hf}$$

And:

$$T_s = T_f - \theta_f Q_t / (60\rho C_p V)$$

Where:

- θ_f = dimensionless temperature calculated by Mundt's formula (1992)
- Q_t = total cooling load in space (Btu/h)
- V = supply air volume (cfm)

$$\theta_f = 1 / ((60V\rho C_p / A)((1/\alpha_r) + (1/\alpha_{cf})) + 1)$$

Where:

- α_r = radiant heat transfer from ceiling to floor (Btu/h-ft^2-°F)
- α_{cf} = convective heat transfer from floor surface to the room air (Btu/h-ft^2-°F)

Assuming that heat transfer coefficients α_r and α_{cf} are equal to 0.9 Btu/(h-ft²-°F) and that T_{hf} should be less than 3.6°F for a seated occupant, this equation can then be simplified to:

$$T_s = T_{sp} - 3.6 - ((AQ_t)/(2.59V^2 + 1.08\,AV))$$

The exhaust air temperature, T_e, can be calculated as:

$$T_e = T_s + ((Q_t)/(1.08V))$$

DESIGN PROCEDURE FOR DISPLACEMENT VENTILATION

The following design procedure is patterned on that provided in an ASHRAE publication entitled 'System Performance and Design Guidelines for Displacement Ventilation' (2003). It was developed based upon the finding of ASHRAE Research Project RP-949.

Step 1 – Calculate the Total Cooling Load

The total cooling load, Q_t, is the sum of the heat loads:

$$Q_t = Q_{oe} + Q_l + Q_{ex}$$

Where:

- Q_{oe} = Heat generated by occupants, desk lamps and office equipment (Btu/h)
- Q_l = Heat generated by overhead lighting (Btu/h)
- Q_{ex} = Heat from the exterior wall and window surfaces including transmitted solar radiation (Btu/h)

Step 2 – Check for Excessive Heat Load

Displacement ventilation is generally not recommended for internal heat loads greater than 30 Btu/ft².

$$Q_t / A \leq 30 \text{ Btu/ft}^2$$

$$A = L \text{ x } W$$

Where:

- A = floor area (ft²)
- L = room length (ft)
- W = room width (ft)

Step 3 – Calculate the Cooling Air Volume

The cooling air volume, V_h, can be determined from heat loads with weighting factors applied:

$$V_h = 0.076Q_{oe} + 0.034Q_l + 0.048Q_{ex}$$

Step 4 – Calculate the Zone Outdoor Airflow for Acceptable Indoor Air Quality

The zone outdoor airflow requirement (cfm), V_{oz}, and the breathing zone outdoor airflow (cfm), V_{bz}, can be determined from ASHRAE Standard 62.1 (Tables 6-1 and 6-2) and the following equations:

$$V_{bz} = (R_p \text{ x } P_z) + (R_a \text{ x } A_z)$$

Where:

- R_p = people outdoor air rate from Table 6-1 (cfm/person)
- P_z = zone population (#)
- R_a = area outdoor air rate from Table 6-1 (cfm/ft²)
- A_z = zone floor area (ft²)

$$V_{oz} = V_{bz} / E_z$$

Where:

- E_z = air change effectiveness from Table 6-2 = 1.2

Step 5 – Determine the Supply Air Volume

The supply air volume, V, will be larger of either the cooling air volume, V_h, or the zone outdoor airflow requirement, V_{oz}.

Step 6 – Calculate the Supply Air Temperature

The supply air temperature, T_s, can be calculated as:

$$T_s = T_{sp} - 3.6 - ((AQ_t)/(2.59V^2 + 1.08\,AV))$$

Where:

- T_{sp} = room temperature (°F)

Step 7 – Calculate the Exhaust Air Temperature

The exhaust air temperature, T_e, can be calculated as:

$$T_e = T_s + ((Q_t)/(1.08V))$$

Step 8 – Select Supply Diffuser(s)

DESIGN EXAMPLE - PRIVATE PERIMETER OFFICE

This a small private office measuring 12 ft by 10 ft by 9 ft (L x W x H). The office is equipped with a computer, a monitor, a small printer and a desk lamp. The 12 ft long wall includes exterior glass. The room will be supplied by a dedicated outdoor air system (DOAS).

Assume:

- Occupancy = 1
- Load per person = 250 Btu/h
- Overhead lighting load = 2 watts/ft² = 6.826 Btu/h-ft²
- Computer load = 65 watts = 222 Btu/h
- Monitor load = 30 watts = 102 Btu/h
- Small printer load = 30 watts = 102 Btu/h
- Desk lamp load = 40 watts = 137 Btu/h
- Solar and glass load = 4.0 Btu/h-ft²

Step 1 – Calculate the Total Cooling Load

$$Q_t = Q_{oe} + Q_l + Q_{ex}$$

Where:

- Q_{oe} = Heat generated by occupants, desk lamps and office equipment (Btu/h)
- Q_l = Heat generated by overhead lighting (Btu/h)
- Q_{ex} = Heat from the exterior wall and window surfaces including transmitted solar radiation (Btu/h)

Q_{oe} = person + computer + monitor + small printer + desk lamp = 813 Btu/h
Q_l = overhead lighting load x floor area = 819 Btu/h
Q_{ex} = solar and glass load x exterior wall area = 432 Btu/h

Q_t = 2064 Btu/h

Step 2 – Check for Excessive Heat Load

Displacement ventilation is generally not recommended for internal heat loads greater than 30 Btu/ft².

$$Q_t / A \leq 30 \text{ Btu/ft}^2$$

$$A = L \text{ x } W$$

Where:

- A = floor area (ft²)
- L = room length (ft)
- W = room width (ft)

$$Q_t / A = 17.2 \text{ Btu/ft}^2$$

Step 3 – Calculate the Cooling Air Volume

The cooling air volume, V_h, can be determined from heat loads with weighting factors applied:

$$V_h = 0.076Q_{oe} + 0.034Q_l + 0.048Q_{ex}$$

V_h = 110 cfm

Step 4 – Calculate the Zone Outdoor Airflow for Acceptable Indoor Air Quality

The zone outdoor airflow requirement (cfm), V_{oz}, and the breathing zone outdoor airflow (cfm), V_{bz}, can be determined from ASHRAE Standard 62.1 (Tables 6-1 and 6-2) and the following equations:

$$V_{bz} = (R_p \text{ x } P_z) + (R_a \text{ x } A_z)$$

Where:

- R_p = people outdoor air rate from Table 6-1 = 5.0 cfm/person
- P_z = zone population (#) = 1
- R_a = area outdoor air rate from Table 6-1 = 0.06 cfm/ft²
- A_z = zone floor area (ft²)

V_{bz} = 12.2 cfm

$$V_{oz} = V_{bz} / E_z$$

Where:

- E_z = air change effectiveness from Table 6-2 = 1.2

V_{oz} = 10.2 cfm

Step 5 – Determine the Supply Air Volume

The supply air volume, V, will be larger of either the cooling air volume, V_h, or the zone outdoor airflow requirement, V_{oz}.

V = 110 cfm

Step 6 – Calculate the Supply Air Temperature

The supply air temperature, T_s, can be calculated as:

$$T_s = T_{sp} - 3.6 - ((AQ_t)/(2.59V^2 + 1.08\,AV))$$

Where:

- T_{sp} = room temperature = 72 °F

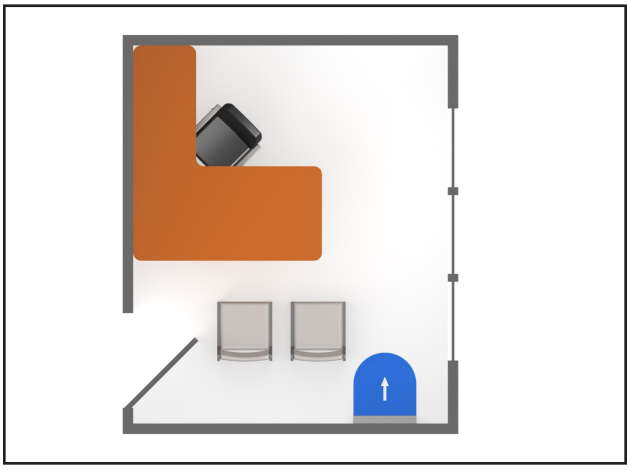


Figure 11. Design Example - Private Perimeter Office

T_s = 63 °F

Step 7 – Calculate the Exhaust Air Temperature

The exhaust air temperature, T_e, can be calculated as:

$$T_e = T_s + ((Q_t)/(1.08V))$$

T_e = 80 °F

Step 8 – Select Supply Diffuser(s)

The best diffuser for this application would be a single flush-mounted wall unit handling 110 cfm. It should ideally be located away from the desk on an opposite wall discharging parallel to the window. Care should be taken in a space this size to ensure that the depth of the adjacent zone is less than 3-4 ft. Since the sound level in a private office is recommended not to exceed a sound level of NC35, the diffuser should be selected for NC25 or less. See Figure 11 for example of diffuser layout.

DESIGN EXAMPLE - OPEN PLAN INTERIOR OFFICE

This is an open plan office for customer service representatives. The office is furnished with workstations to accommodate up to sixteen employees and measures 40 ft by 40 ft by 12 ft (L x W x H). Each workstation is equipped with a computer, a monitor and a desk lamp. There is also a single large printer that is shared. The room will be supplied by a conventional air handler that will mix return air with outdoor air.

Assume:

- Occupancy = 16
- Load per person = 250 Btu/h
- Overhead lighting load = 2 watts/ft² = 6.826 Btu/h-ft²
- Computer load = 65 watts = 222 Btu/h
- Monitor load = 30 watts = 102 Btu/h
- Large printer load = 110 watts = 375 Btu/h
- Desk lamp load = 40 watts = 137 Btu/h

Step 1 – Calculate the Total Cooling Load

$$Q_t = Q_{oe} + Q_l + Q_{ex}$$

Where:

- Q_{oe} = Heat generated by occupants, desk lamps and office equipment (Btu/h)

- Q_l = Heat generated by overhead lighting (Btu/h)
- Q_{ex} = Heat from the exterior wall and window surfaces including transmitted solar radiation (Btu/h)

Q_{oe} = (16) people + (16) computers + (16) monitors + (1) large printer + (16) desk lamps = 11751 Btu/h
Q_l = overhead lighting load x floor area = 10922 Btu/h
Q_{ex} = 0 Btu/h

Q_t = 22673 Btu/h

Step 2 – Check for Excessive Heat Load

Displacement ventilation is generally not recommended for internal heat loads greater than 30 Btu/ft².

$$Q_t / A \leq 30 \text{ Btu/ft}^2$$

$$A = L \text{ x } W$$

Where:

- A = floor area (ft²)
- L = room length (ft)
- W = room width (ft)

$$Q_t / A = 17.2 \text{ Btu/ft}^2$$

Step 3 – Calculate the Cooling Air Volume

The cooling air volume, V_h, can be determined from heat loads with weighting factors applied:

$$V_h = 0.076Q_{oe} + 0.034Q_l + 0.048Q_{ex}$$

V_h = 1264 cfm

Step 4 – Calculate the Zone Outdoor Airflow for Acceptable Indoor Air Quality

The zone outdoor airflow requirement (cfm), V_{oz}, and the breathing zone outdoor airflow (cfm), V_{bz}, can be determined from ASHRAE Standard 62.1 (Tables 6-1 and 6-2) and the following equations:

$$V_{bz} = (R_p \text{ x } P_z) + (R_a \text{ x } A_z)$$

Where:

- R_p = people outdoor air rate from Table 6-1 = 5.0 cfm/person
- P_z = zone population (#) = 16
- R_a = area outdoor air rate from Table 6-1 = 0.06 cfm/ft²
- A_z = zone floor area (ft²)

V_{bz} = 176 cfm

$$V_{oz} = V_{bz} / E_z$$

Where:

- E_z = air change effectiveness from Table 6-2 = 1.2

V_{oz} = 147 cfm

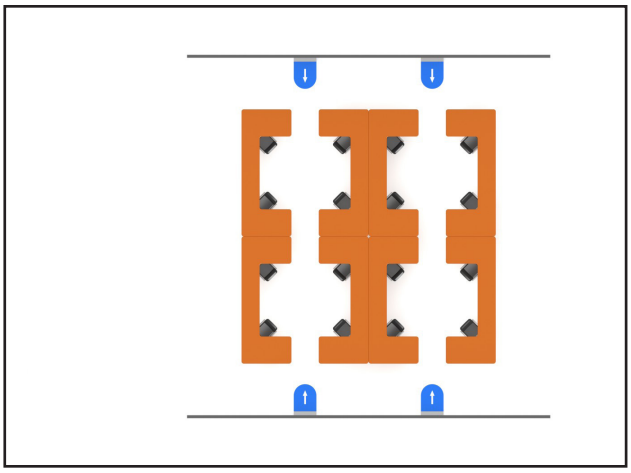


Figure 12. Design Example - Open Plan Interior Office

Step 5 – Determine the Supply Air Volume

The supply air volume, V, will be larger of either the cooling air volume, V_h, or the zone outdoor airflow requirement, V_{oz}.

V = 1264 cfm

Since the air handler will be mixing return air with outdoor air, we must calculate the required percentage of outdoor air to satisfy the zone outdoor air requirement, V_{oz}.

V_{oz} / V = 12%

Step 6 – Calculate the Supply Air Temperature

The supply air temperature, T_s, can be calculated as:

$$T_s = T_{sp} - 3.6 - ((AQ_t)/(2.59V^2 + 1.08\,AV))$$

Where:

- T_{sp} = room temperature = 74 °F

T_s = 65 °F

Step 7 – Calculate the Exhaust Air Temperature

The exhaust air temperature, T_e, can be calculated as:

$$T_e = T_s + ((Q_t)/(1.08V))$$

T_e = 81 °F

Step 8 – Select Supply Diffuser(s)

There are many different diffuser selections that could work well in this space. Flat front or bow-fronted diffusers either flush-mounted or surface-mounted would be best. The exact model choice comes down to appearance and architectural limitations. The best arrangement would be to place pairs of diffusers on opposite walls such that they discharge down the aisles between work stations. This would require four diffusers each handling 316 cfm, selected for an adjacent zone with a depth of less than 4-5 ft. This should be adequate to achieve coverage to the center of the room. Since the ideal sound level for an open plan office is NC40, the diffusers should be selected for NC30 or less. See Figure 12 for example of diffuser layout.

DESIGN EXAMPLE - PERIMETER CONFERENCE ROOM

This is a conference room with an exterior window. The room is equipped with a computer and a projector and is intended for a maximum occupancy of twelve. It measures 30 ft by 15 ft by 10 ft (L x W x H). The window is located on the longest wall. The room will be supplied by a conventional air handler that will mix return air with outdoor air.

Assume:

- Occupancy = 12
- Load per person = 250 Btu/h
- Overhead lighting load = 2 watts/ft² = 6.826 Btu/h-ft²
- Computer load = 65 watts = 222 Btu/h
- Projector load = 200 watts = 683 Btu/h
- Solar and glass load = 4.0 Btu/h-ft²

Step 1 – Calculate the Total Cooling Load

$$Q_t = Q_{oe} + Q_l + Q_{ex}$$

Where:

- Q_{oe} = Heat generated by occupants, desk lamps and office equipment (Btu/h)
- Q_l = Heat generated by overhead lighting (Btu/h)
- Q_{ex} = Heat from the exterior wall and window surfaces including transmitted solar radiation (Btu/h)

Q_{oe} = (12) people + computer + projector = 3905 Btu/h
Q_l = overhead lighting load x floor area = 3072 Btu/h
Q_{ex} = solar and glass load x exterior wall area = 1200 Btu/h

Q_t = 8177 Btu/h

Step 2 – Check for Excessive Heat Load

Displacement ventilation is generally not recommended for internal heat loads greater than 30 Btu/ft².

$$Q_t / A \leq 30 \text{ Btu/ft}^2$$

$$A = L \text{ x } W$$

Where:

- A = floor area (ft²)
- L = room length (ft)
- W = room width (ft)

$$Q_t / A = 18.2 \text{ Btu/ft}^2$$

Step 3 – Calculate the Cooling Air Volume

The cooling air volume, V_h, can be determined from heat loads with weighting factors applied:

$$V_h = 0.076Q_{oe} + 0.034Q_l + 0.048Q_{ex}$$

V_h = 459 cfm

Step 4 – Calculate the Zone Outdoor Airflow for Acceptable Indoor Air Quality

The zone outdoor airflow requirement (cfm), V_{oz}, and the breathing zone outdoor airflow (cfm), V_{bz}, can be determined from ASHRAE Standard 62.1 (Tables 6-1 and 6-2) and the following equations:

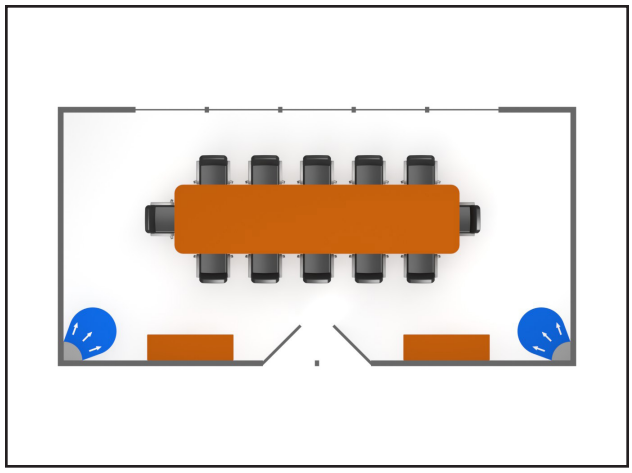


Figure 13. Design Example - Perimeter Conference Room

$$V_{bz} = (R_p \text{ x } P_z) + (R_a \text{ x } A_z)$$

Where:

- R_p = people outdoor air rate from Table 6-1 = 5.0 cfm/person
- P_z = zone population (#) = 1
- R_a = area outdoor air rate from Table 6-1 = 0.06 cfm/ft²
- A_z = zone floor area (ft²)

V_{bz} = 87 cfm

$$V_{oz} = V_{bz} / E_z$$

Where:

- E_z = air change effectiveness from Table 6.2 = 1.2

V_{oz} = 72.5 cfm

Step 5 – Determine the Supply Air Volume

The supply air volume, V, will be larger of either the cooling air volume, V_h, or the zone outdoor airflow requirement, V_{oz}.

V = 459 cfm

Since the air handler will be mixing return air with outdoor air, we must calculate the required percentage of outdoor air to satisfy the zone outdoor air requirement, V_{oz}.

V_{oz} / V = 16%

Step 6 – Calculate the Supply Air Temperature

The supply air temperature, T_s, can be calculated as:

$$T_s = T_{sp} - 3.6 - ((AQ_t)/(2.59V^2 + 1.08\,AV))$$

Where:

- T_{sp} = room temperature = 72 °F

T_s = 64 °F

Step 7 – Calculate the Exhaust Air Temperature

The exhaust air temperature, T_e, can be calculated as:

$$T_e = T_s + ((Q_t)/(1.08V))$$

T_e = 80 °F

Step 8 – Select Supply Diffuser(s)

The best choice for this application would be a pair of 90-degree air pattern diffusers located on the interior corners of the room. Each diffuser will handle 230 cfm and should be selected for an adjacent zone no deeper than 4-5 ft. Since the typical sound level for a conference room should not exceed NC30, the diffusers should be selected for NC20 or less. See Figure 13 for example of diffuser layout.

DESIGN EXAMPLE - INTERIOR BREAKROOM

This is a breakroom without windows. The room is equipped with a water cooler, a coffee machine, a microwave oven, an ice maker, a refrigerator, a cold beverage machine, and a snack machine. It measures 40 ft by 32 ft by 12 ft (L x W x H). The room will be supplied by a conventional air handler that will mix return air with outdoor air.

Assume:

- Occupancy = 40
- Load per person = 250 Btu/h
- Overhead lighting load = 2 watts/ft² = 6.826 Btu/h-ft²
- Water cooler load = 350 watts = 1195 Btu/h
- Coffee machine load = 1000 watts = 3413 Btu/h
- Microwave oven load = 200 watts = 683 Btu/h
- Ice maker load = 400 watts = 1365 Btu/h
- Refrigerator load = 700 watts = 2389 Btu/h
- Cold beverage machine load = 800 watts = 2730 Btu/h
- Snack machine load = 250 watts = 853 Btu/h

Step 1 – Calculate the Total Cooling Load

$$Q_t = Q_{oe} + Q_l + Q_{ex}$$

Where:

- Q_{oe} = Heat generated by occupants, desk lamps and office equipment (Btu/h)
- Q_l = Heat generated by overhead lighting (Btu/h)
- Q_{ex} = Heat from the exterior wall and window surfaces including transmitted solar radiation (Btu/h)

Q_{oe} = (40) people + water cooler + coffee machine + microwave oven + ice maker + refrigerator + cold beverage machine + snack machine = 22628 Btu/h

Q_l = overhead lighting load x floor area = 8737 Btu/h

Q_t = 31365 Btu/h

Q_{ex} = 0 Btu/h

Step 2 – Check for Excessive Heat Load

Displacement ventilation is generally not recommended for internal heat loads greater than 30 Btu/ft².

$$Q_t / \mathrm{A} \leq 30 \text{ Btu/ft}^2$$

$$A = L \text{ x } W$$

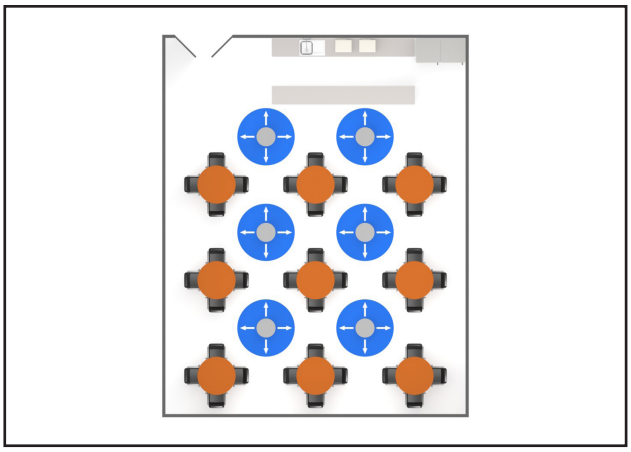


Figure 14. Design Example - Interior Breakroom

Where:

- A = floor area (ft²)
- L = room length (ft)
- W = room width (ft)

Q_t / A = 24.5 Btu/ft²

Step 3 – Calculate the Cooling Air Volume

The cooling air volume, V_h, can be determined from heat loads with weighting factors applied:

$$V_h = 0.076Q_{oe} + 0.034Q_l + 0.048Q_{ex}$$

V_h = 2017 cfm

Step 4 – Calculate the Zone Outdoor Airflow for Acceptable Indoor Air Quality

The zone outdoor airflow requirement (cfm), V_{oz}, and the breathing zone outdoor airflow (cfm), V_{bz}, can be determined from ASHRAE Standard 62.1 (Tables 6-1 and 6-2) and the following equations:

$$V_{bz} = (R_p \text{ x } P_z) + (R_a \text{ x } A_z)$$

Where:

- R_p = people outdoor air rate from Table 6-1 = 5.0 cfm/person
- P_z = zone population (#) = 1
- R_a = area outdoor air rate from Table 6-1 = 0.06 cfm/ft²
- A_z = zone floor area (ft²)

V_{bz} = 354 cfm

$$V_{oz} = V_{bz} / E_z$$

Where:

- E_z = air change effectiveness from Table 6.2 = 1.2

V_{oz} = 295 cfm

Step 5 – Determine the Supply Air Volume

The supply air volume, V, will be larger of either the cooling air volume, V_h, or the zone outdoor airflow requirement, V_{oz}.

V = 2017 cfm

Since the air handler will be mixing return air with outdoor air, we must calculate the required percentage of outdoor air to satisfy the zone outdoor air requirement, V_{oz}.

V_{oz} / V = 15%

Step 6 – Calculate the Supply Air Temperature

The supply air temperature, T_s, can be calculated as:

$$T_s = T_{sp} - 3.6 - ((AQ_t)/(2.59V^2 + 1.08\,AV))$$

Where:

- T_{sp} = room temperature = 72 °F

T_s = 65 °F

Step 7 – Calculate the Exhaust Air Temperature

The exhaust air temperature, T_e, can be calculated as:

$$T_e = T_s + ((Q_t)/(1.08V))$$

T_e = 80 °F

Step 8 – Select Supply Diffuser(s)

There are many possible choices, but large open spaces can be easily served with 360-degree air pattern diffusers located away from the walls. Although four diffusers each handling 504 cfm might work, six diffusers each handling 336 cfm would result in shorter throws and smaller adjacent zones. Sound levels in cafeterias and breakrooms are seldom critical, but selecting the diffusers for NC25 or less is advisable. See Figure 14 for example of diffuser layout.

DESIGN EXAMPLE - ELEMENTARY SCHOOL CLASSROOM

This is a school classroom with an exterior window. The room is equipped with a computer and a projector and is intended for a maximum occupancy of one teacher and (25) students. The room is equipped with (5) computers, (5) monitors and a projector. It measures 30 ft by 30 ft by 10 ft (L x W x H). The room will be supplied by a conventional air handler that will mix return air with outdoor air.

Assume:

- Occupancy = 26
- Load per person = 250 Btu/h
- Overhead lighting load = 2 watts/ft² = 6.826 Btu/h-ft²
- Computer load = 65 watts = 222 Btu/h
- Monitor load = 30 watts = 102 Btu/h
- Projector load = 200 watts = 683 Btu/h
- Solar and glass load = 10.5 Btu/h-ft²

Step 1 – Calculate the Total Cooling Load

$$Q_t = Q_{oe} + Q_l + Q_{ex}$$

Where:

- Q_{oe} = Heat generated by occupants, desk lamps and office equipment (Btu/h)
- Q_l = Heat generated by overhead lighting (Btu/h)
- Q_{ex} = Heat from the exterior wall and window surfaces including transmitted solar radiation (Btu/h)

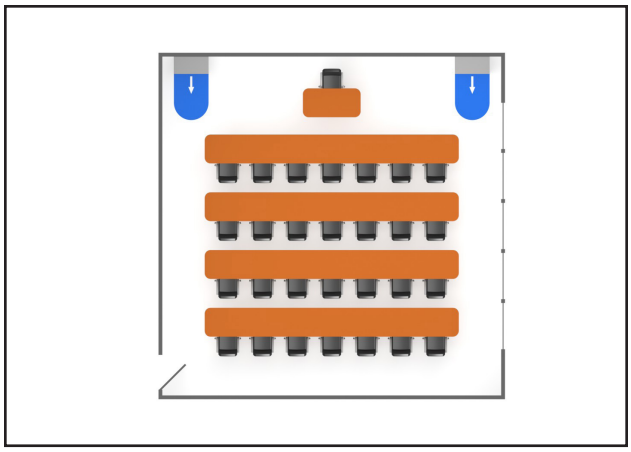


Figure 15. Design Example - Elementary School Classroom

Q_{oe} = (26) people + (5) computers + (5) monitors + projector = 8803 Btu/h
Q_l = overhead lighting load x floor area = 6143 Btu/h
Q_{ex} = solar and glass load x exterior wall area = 3150 Btu/h

Q_t = 18096 Btu/h

Step 2 – Check for Excessive Heat Load

Displacement ventilation is generally not recommended for internal heat loads greater than 30 Btu/ft².

$$Q_t / A \leq 30 \text{ Btu/ft}^2$$

$$A = L \text{ x } W$$

Where:

- A = floor area (ft²)
- L = room length (ft)
- W = room width (ft)

Q_t / A = 20.1 Btu/ft²

Step 3 – Calculate the Cooling Air Volume

The cooling air volume, V_h, can be determined from heat loads with weighting factors applied:

$$V_h = 0.076Q_{oe} + 0.034Q_l + 0.048Q_{ex}$$

V_h = 1029 cfm

Step 4 – Calculate the Zone Outdoor Airflow for Acceptable Indoor Air Quality

The zone outdoor airflow requirement (cfm), V_{oz}, and the breathing zone outdoor airflow (cfm), V_{bz}, can be determined from ASHRAE Standard 62.1 (Tables 6-1 and 6-2) and the following equations:

$$V_{bz} = (R_p \text{ x } P_z) + (R_a \text{ x } A_z)$$

Where:

- R_p = people outdoor air rate from Table 6-1 = 5.0 cfm/person
- P_z = zone population (#) = 1

- R_a = area outdoor air rate from Table 6-1 = 0.06 cfm/ft^2
- A_z = zone floor area (ft^2)

V_{bz} = 368 cfm

$V_{oz} = V_{bz} / E_z$

Where:

- E_z = air change effectiveness from Table 6-2 = 1.2

V_{oz} = 307 cfm

Step 5 – Determine the Supply Air Volume

The supply air volume, V, will be larger of either the cooling air volume, V_h, or the zone outdoor airflow requirement, V_{oz}.

V = 1029 cfm

Since the air handler will be mixing return air with outdoor air, we must calculate the required percentage of outdoor air to satisfy the zone outdoor air requirement, V_{oz}.

V_{oz} / V = 30%

Step 6 – Calculate the Supply Air Temperature

The supply air temperature, T_s, can be calculated as:

$T_s = T_{sp} - 3.6 - ((AQ_t)/(2.59V^2 + 1.08\,AV))$

Where:

- T_{sp} = room temperature = 74 °F

T_s = 66 °F

Step 7 – Calculate the Exhaust Air Temperature

The exhaust air temperature, T_e, can be calculated as:

$T_e = T_s + ((Q_t)/(1.08V))$

T_e = 82 °F

Step 8 – Select Supply Diffuser(s)

Perimeter classrooms are typically arranged with the instructor's desk at one end of the room, the student desks in rows facing the teacher and windows perpendicular desk rows. The most common diffuser arrangement for this room layout would require a diffuser on each side of the teacher's desk discharging down the side aisles. Each diffuser would handle 515 cfm and the adjacent zone depth should be no more than 4-5 ft. Since sound levels in elementary school classrooms are critical to the learning environment and are recommended not to exceed NC25-30, the diffusers should be selected for NC15 or less so as not to be heard. See Figure 15 for example of diffuser layout.

References

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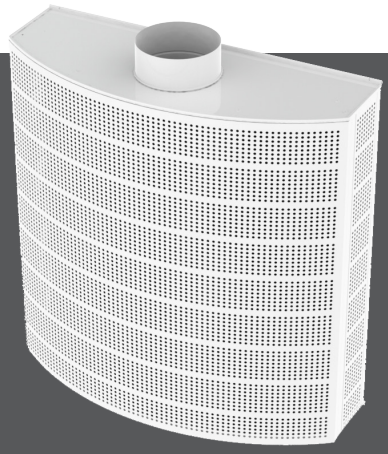
Titus
Redefine your comfort zone.™

Rectangular Displacement

DVBC

- Rectangular displacement diffuser with curved face for wall mount applications
- Designed to supply a large volume of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Mounting base and telescopic duct cover are available as accessories



DVBC

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

DVBC

FINISHES

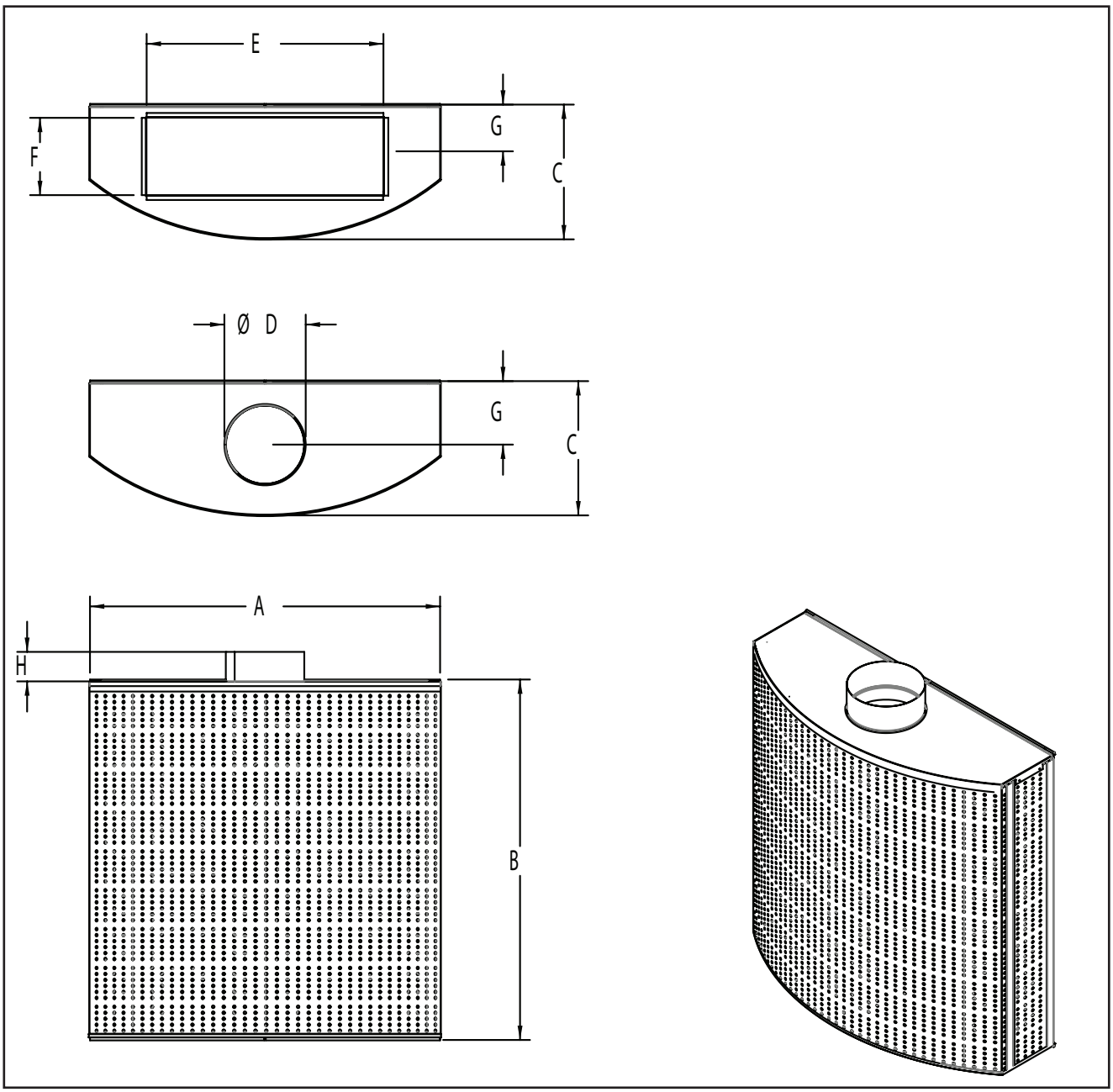
Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

OVERVIEW

The DVBC is a rectangular displacement diffuser with a curved face for wall mount applications. It is designed to supply a large volume of air at low velocities into the occupied zone. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design

DVBC displacement ventilation diffusers installed in a LEED Certified high school

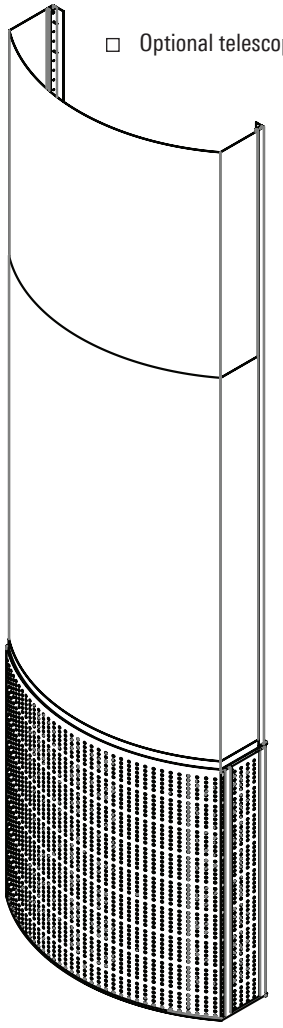
DVBC UNIT DIMENSIONS



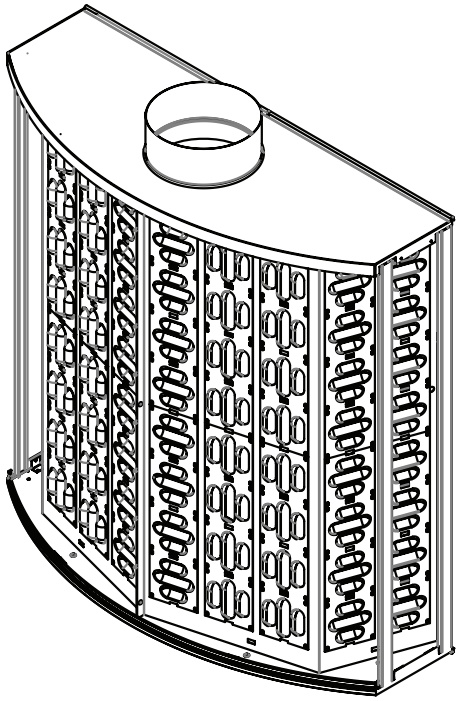
Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)							
			A	B	C	D	E	F	G	H
DVBC	8	36 x 37	35 7/16	36 5/16	13 3/8	7 7/8	N/A	N/A	6 1/4	3 1/4
	10	36 x 37	35 7/16	36 5/16	15 3/8	9 7/8	N/A	N/A	7 1/4	3 1/4
	12	36 x 60	35 7/16	60	18	11 7/8	N/A	N/A	8 1/2	3 1/4
	16	36 x 39	35 7/16	78 7/8	21 1/4	15 7/8	N/A	N/A	10 3/16	3 1/4
	24 x 8	36 x 39	35 7/16	78 7/8	13 3/8	N/A	23 7/8	7 7/8	7 1/8	2
	24 x 12	36 x 39	35 7/16	78 7/8	18	N/A	23 7/8	11 7/8	5 1/16	2

All dimensions are in inches

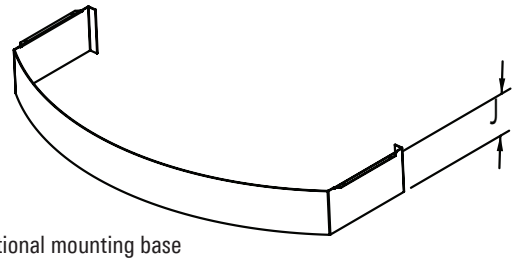
☐ Optional telescopic duct cover



*Does not include mounting base height



View with face removed showing integral variable air pattern controllers



☐ Optional mounting base
Height (J): 2-3/4" or 4"

Unit Size	Diffuser height with duct cover kit*	
	Min	Max
36 x 37	92 1/8	124
36 x 37		
36 x 60		
36 x 79	109 7/8	
36 x 79		
36 x 79		

*Height dimensions do not include mounting base

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

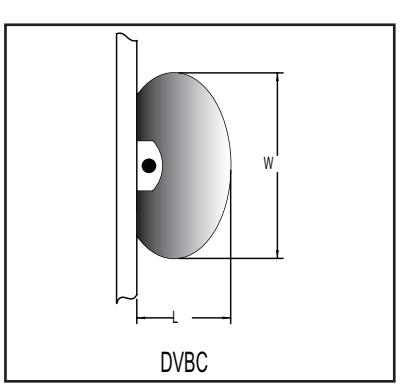
All dimensions are in inches

DVBC

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
36" x 37"	8" Dia	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.003	0.007	0.012	0.019	0.027	0.036	0.047
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	2-5	3-7	4-9	4-10	5-12	6-13	6-14
		Adjacent Zone (AZ) Δ10°	2-6	3-8	4-10	5-11	5-13	6-14	7-16
36" x 37"	10" Dia	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.009	0.016	0.025	0.036	0.049	0.064
		NC (Noise Criteria)	-	-	-	-	-	-	10
		Adjacent Zone (AZ) Δ5°	3-7	4-10	5-12	6-14	7-16	8-18	9-20
		Adjacent Zone (AZ) Δ10°	3-8	4-11	5-13	6-15	7-18	8-20	9-22
36" x 60"	12" Dia	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.039	0.052
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	4-9	5-12	6-15	8-18	9-20	10-23	12-25
		Adjacent Zone (AZ) Δ10°	4-10	5-14	7-17	8-20	10-22	11-25	12-28
36" x 79"	16" Dia	Airflow, cfm	275	412	550	687	825	962	1100
		Total Pressure	0.004	0.009	0.016	0.025	0.037	0.050	0.065
		NC (Noise Criteria)	-	-	-	-	-	10	14
		Adjacent Zone (AZ) Δ5°	6-13	8-18	10-22	12-26	14-30	16-34	18-37
		Adjacent Zone (AZ) Δ10°	6-15	8-20	11-25	13-29	15-33	17-37	19-41
36" x 79"	24" x 8"	Airflow, cfm	261	392	522	653	783	914	1045
		Total Pressure	0.005	0.010	0.018	0.029	0.041	0.056	0.074
		NC (Noise Criteria)	-	-	-	-	-	12	16
		Adjacent Zone (AZ) Δ5°	6-14	9-19	11-23	13-28	16-32	18-35	20-39
		Adjacent Zone (AZ) Δ10°	7-16	9-21	12-26	14-31	17-35	19-39	21-43
36" x 79"	24" x 12"	Airflow, cfm	394	591	788	984	1181	1378	1575
		Total Pressure	0.006	0.013	0.024	0.037	0.054	0.073	0.096
		NC (Noise Criteria)	-	-	-	-	12	16	20
		Adjacent Zone (AZ) Δ5°	8-18	11-24	14-30	17-36	20-41	23-46	26-50
		Adjacent Zone (AZ) Δ10°	8-20	12-27	15-33	18-39	21-45	24-50	27-56

PERFORMANCE NOTES

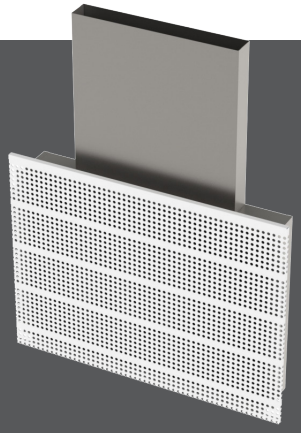
- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DVBC

DVIR

- Rectangular displacement diffuser with 1-way discharge designed for flush mount applications
- Designed to supply small to medium volumes of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Optional duct cover (fixed length: 78-3/4")
- Standard finish is #26 white (powdercoat)



DVIR

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

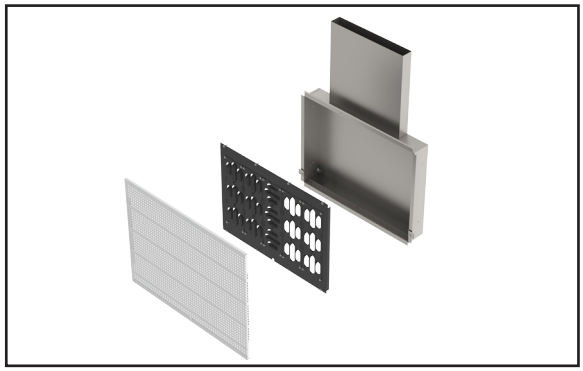
DVIR

FINISHES

Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

OVERVIEW

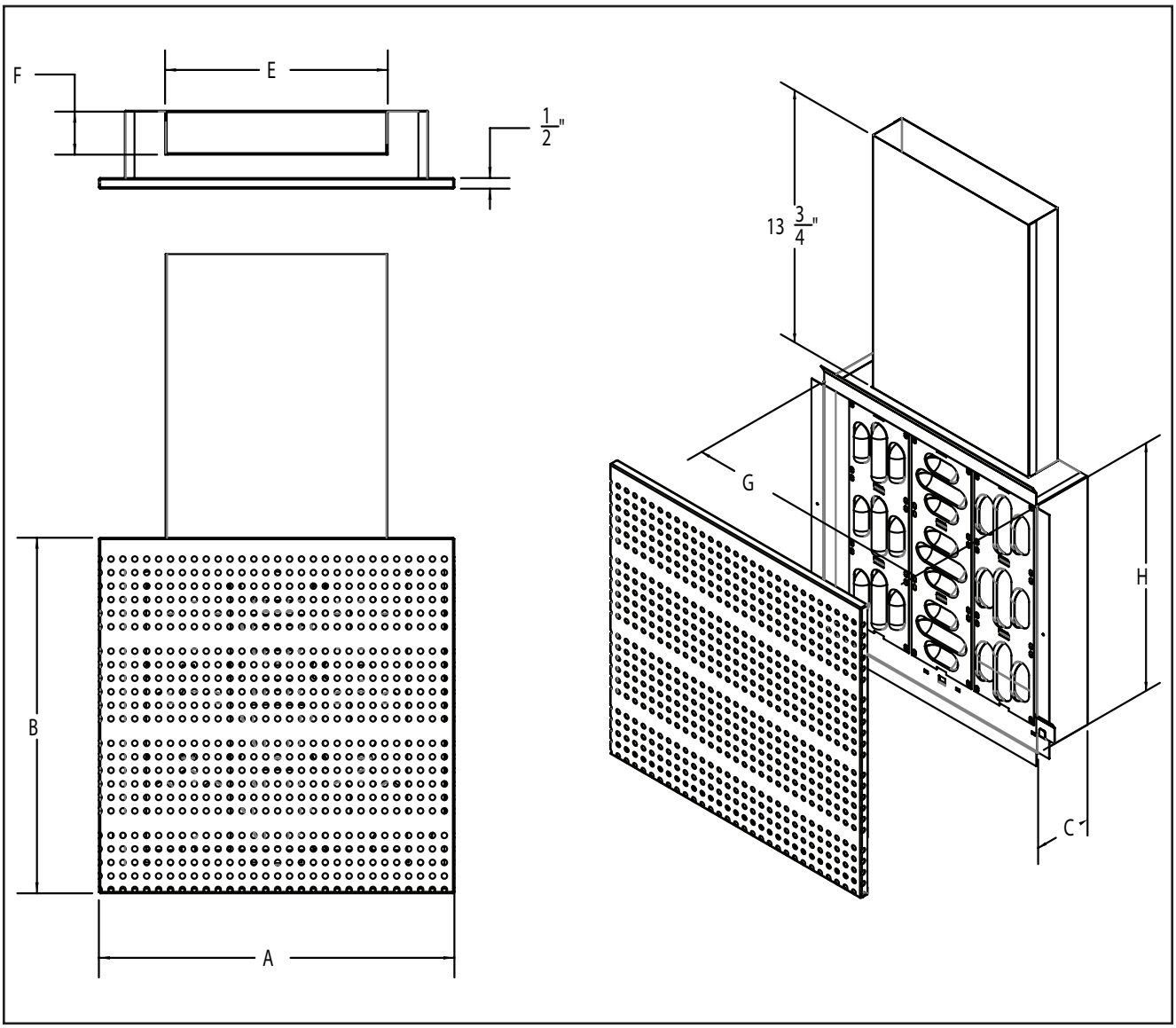
The DVIR is a rectangular displacement diffuser with a one-way discharge pattern designed for flush mount applications. Constructed of galvanized steel and aluminum, the DVIR is designed for in-wall applications and supplies a large volume of air at low velocities into the occupied zone. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.



Above: Exploded view of the DVIR displacement ventilation diffuser

Below: Installed view of DVIR displacement ventilation diffusers in an auditorium

DVIR UNIT DIMENSIONS

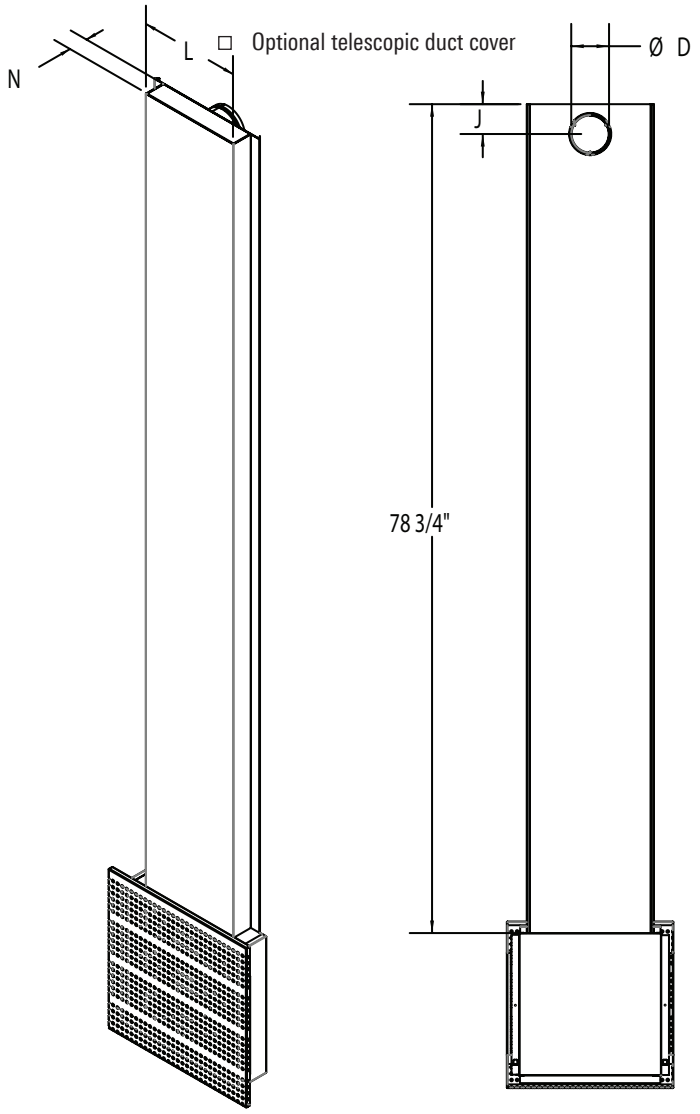


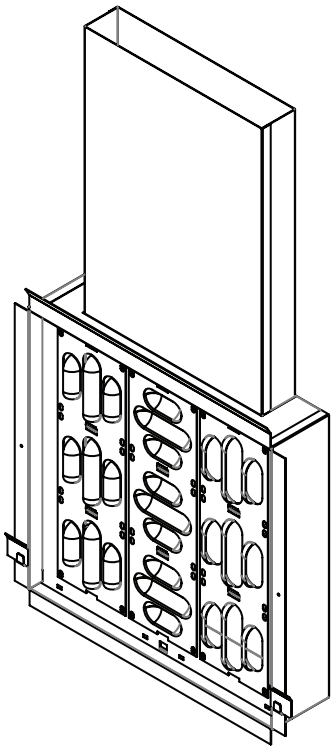
Exploded view of the DVIR Displacement Diffuser

All dimensions are in inches

DVIR UNIT DIMENSIONS

Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)						
			A	B	C	E	F	G	H
DVIR	6 x 2	12 x 10	12	10	3 1/8	5 7/8	1 7/8	9 11/16	7 13/16
	6 x 2	12 x 12	12	12	3 1/8	5 7/8	1 7/8	9 11/16	9 13/16
	10 x 2	16 x 10	16	10	3 1/8	9 7/8	1 7/8	13 11/16	7 13/16
	10 x 2	16 x 12	16	12	3 1/8	9 7/8	1 7/8	13 11/16	9 13/16
	10 x 2	16 x 16	16	16	3 1/8	9 7/8	1 7/8	13 11/16	13 13/16
	10 x 2	16 x 24	16	24	3 1/8	9 7/8	1 7/8	13 11/16	21 13/16
	12 x 2	20 x 20	20	20	3 1/8	11 7/8	1 7/8	17 7/16	17 13/16
	14 x 2	24 x 12	24	12	3 1/8	13 7/8	1 7/8	21 11/16	9 13/16
	14 x 2	24 x 18	24	18	3 1/8	13 7/8	1 7/8	21 11/16	16
	14 x 2	24 x 24	24	24	3 1/8	13 7/8	1 7/8	21 11/16	21 13/16
	20 x 3	24 x 30	24	30	4	19 7/8	2 7/8	21 11/16	27 13/16
	20 x 3	24 x 36	24	36	4	19 7/8	2 7/8	21 11/16	33 13/16
	20 x 3	24 x 48	24	48	4	19 7/8	2 7/8	21 11/16	45 13/16
	20 x 3	30 x 24	30	24	4	19 7/8	2 7/8	27 11/16	21 13/16
	20 x 3	36 x 12	36	12	4	19 7/8	2 7/8	33 11/16	9 13/16
	20 x 3	36 x 24	36	24	4	19 7/8	2 7/8	33 11/16	21 13/16
	20 x 3	48 x 12	48	12	4	19 7/8	2 7/8	45 11/16	9 13/16
	20 x 3	48 x 24	48	24	4	19 7/8	2 7/8	45 11/16	21 13/16
	24 x 3	60 x 24	60	24	4	23 7/8	2 7/8	57 11/16	21 13/16





View with face removed showing integral variable air pattern controllers

Model	Inlet Size	Inlet Dimensions (inches)			
		D	J	L	N
DVIR	8	3 7/8	2 7/8	6 1/16	2
	12	3 7/8	2 7/8	10 1/16	2
	14	4 7/8	3 7/16	12 1/16	2
	16	5 7/8	4 1/8	14 1/16	2
	23	7 7/8	4 15/16	20 1/16	3
	27	9 7/8	5 15/16	24 1/16	3

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

All dimensions are in inches

DVIR

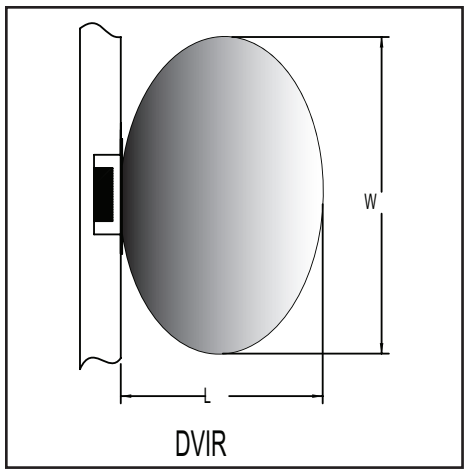
Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
16" x 16"	10" x 2"	Airflow, cfm	26	39	53	66	79	92	105
		Total Pressure	0.008	0.019	0.034	0.053	0.076	0.103	0.135
		NC (Noise Criteria)	-	-	-	10	16	21	25
		Adjacent Zone (AZ) Δ5°	2-3	2-5	2-7	3-8	3-10	3-11	3-13
		Adjacent Zone (AZ) Δ10°	2-4	3-6	3-7	3-9	4-11	4-13	4-14
16" x 24"	10" x 2"	Airflow, cfm	26	39	53	66	79	92	105
		Total Pressure	0.005	0.011	0.019	0.030	0.043	0.059	0.076
		NC (Noise Criteria)	-	-	-	-	14	19	23
		Adjacent Zone (AZ) Δ5°	2-3	2-5	2-7	3-8	3-10	3-11	3-13
		Adjacent Zone (AZ) Δ10°	2-4	3-6	3-7	3-9	4-11	4-13	4-14
20" x 20"	12" x 2"	Airflow, cfm	32	47	63	79	95	111	126
		Total Pressure	0.005	0.012	0.021	0.033	0.048	0.066	0.085
		NC (Noise Criteria)	-	-	-	-	15	20	24
		Adjacent Zone (AZ) Δ5°	2-3	2-5	3-7	3-8	3-10	4-12	4-13
		Adjacent Zone (AZ) Δ10°	3-4	3-6	4-7	4-9	4-11	5-13	5-14
24" x 24"	14" x 2"	Airflow, cfm	37	55	74	92	111	129	148
		Total Pressure	0.004	0.009	0.017	0.026	0.038	0.051	0.067
		NC (Noise Criteria)	-	-	-	-	14	19	23
		Adjacent Zone (AZ) Δ5°	2-3	3-5	3-7	4-8	4-10	4-12	5-13
		Adjacent Zone (AZ) Δ10°	3-4	4-6	4-8	5-9	5-11	5-13	6-15
24" x 30"	20" x 3"	Airflow, cfm	80	121	161	201	241	282	322
		Total Pressure	0.007	0.017	0.030	0.047	0.068	0.093	0.121
		NC (Noise Criteria)	-	-	-	12	17	22	26
		Adjacent Zone (AZ) Δ5°	3-7	4-11	5-14	5-18	6-21	6-25	7-28
		Adjacent Zone (AZ) Δ10°	4-8	5-12	6-16	7-20	7-23	8-27	8-31
24" x 36"	20" x 3"	Airflow, cfm	80	121	161	201	241	282	322
		Total Pressure	0.005	0.012	0.022	0.034	0.049	0.067	0.087
		NC (Noise Criteria)	-	-	-	11	16	21	25
		Adjacent Zone (AZ) Δ5°	3-7	4-11	5-14	5-18	6-21	6-25	7-28
		Adjacent Zone (AZ) Δ10°	4-8	5-12	6-16	7-20	7-23	8-27	8-31
24" x 48	20" x 3"	Airflow, cfm	80	121	161	201	241	282	322
		Total Pressure	0.004	0.009	0.017	0.026	0.037	0.051	0.066
		NC (Noise Criteria)	-	-	-	10	15	20	24
		Adjacent Zone (AZ) Δ5°	3-7	4-11	5-14	5-18	6-21	6-25	7-28
		Adjacent Zone (AZ) Δ10°	4-8	5-12	6-16	7-20	7-23	8-27	8-31
30" x 24"	20" x 3"	Airflow, cfm	80	121	161	201	241	282	322
		Total Pressure	0.007	0.017	0.030	0.047	0.068	0.093	0.121
		NC (Noise Criteria)	-	-	-	12	17	22	26
		Adjacent Zone (AZ) Δ5°	4-6	5-9	5-12	6-15	6-18	7-21	7-23
		Adjacent Zone (AZ) Δ10°	5-7	6-10	6-13	7-17	8-20	8-23	9-26
36" x 24"	20" x 3"	Airflow, cfm	80	121	161	201	241	282	322
		Total Pressure	0.005	0.012	0.022	0.034	0.049	0.067	0.087
		NC (Noise Criteria)	-	-	-	11	16	21	25
		Adjacent Zone (AZ) Δ5°	4-5	5-8	6-10	6-13	7-15	7-18	8-20
		Adjacent Zone (AZ) Δ10°	5-6	6-9	7-12	8-14	8-17	9-20	10-23

DVIR (continued)

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
48" x 24"	20" x 3"	Airflow, cfm	80	121	161	201	241	282	322
		Total Pressure	0.004	0.010	0.018	0.028	0.040	0.055	0.071
		NC (Noise Criteria)	-	-	-	10	16	20	25
		Adjacent Zone (AZ) ΔT5°	4-4	5-6	6-8	7-10	7-12	8-14	9-16
		Adjacent Zone (AZ) ΔT10°	6-5	7-7	8-9	9-11	9-14	10-16	11-18
60" x 24"	24" x 3"	Airflow, cfm	97	145	193	242	290	338	387
		Total Pressure	0.004	0.009	0.016	0.025	0.036	0.049	0.064
		NC (Noise Criteria)	-	-	-	10	15	20	24
		Adjacent Zone (AZ) ΔT5°	5-4	6-6	7-8	8-10	9-12	10-14	10-16
		Adjacent Zone (AZ) ΔT10°	7-5	8-7	9-9	10-12	11-14	12-16	13-18

PERFORMANCE NOTES

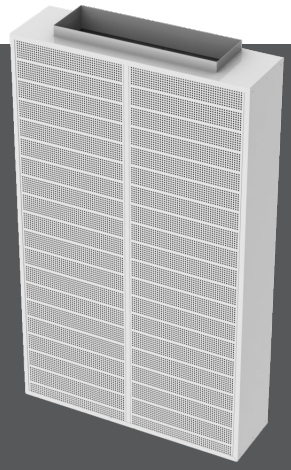
- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DVIR

DVRI

- Rectangular displacement diffuser with curved face for wall mount applications
- Designed to supply a large volume of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Mounting base and telescopic duct cover available as accessories



DVRI

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

DVRI

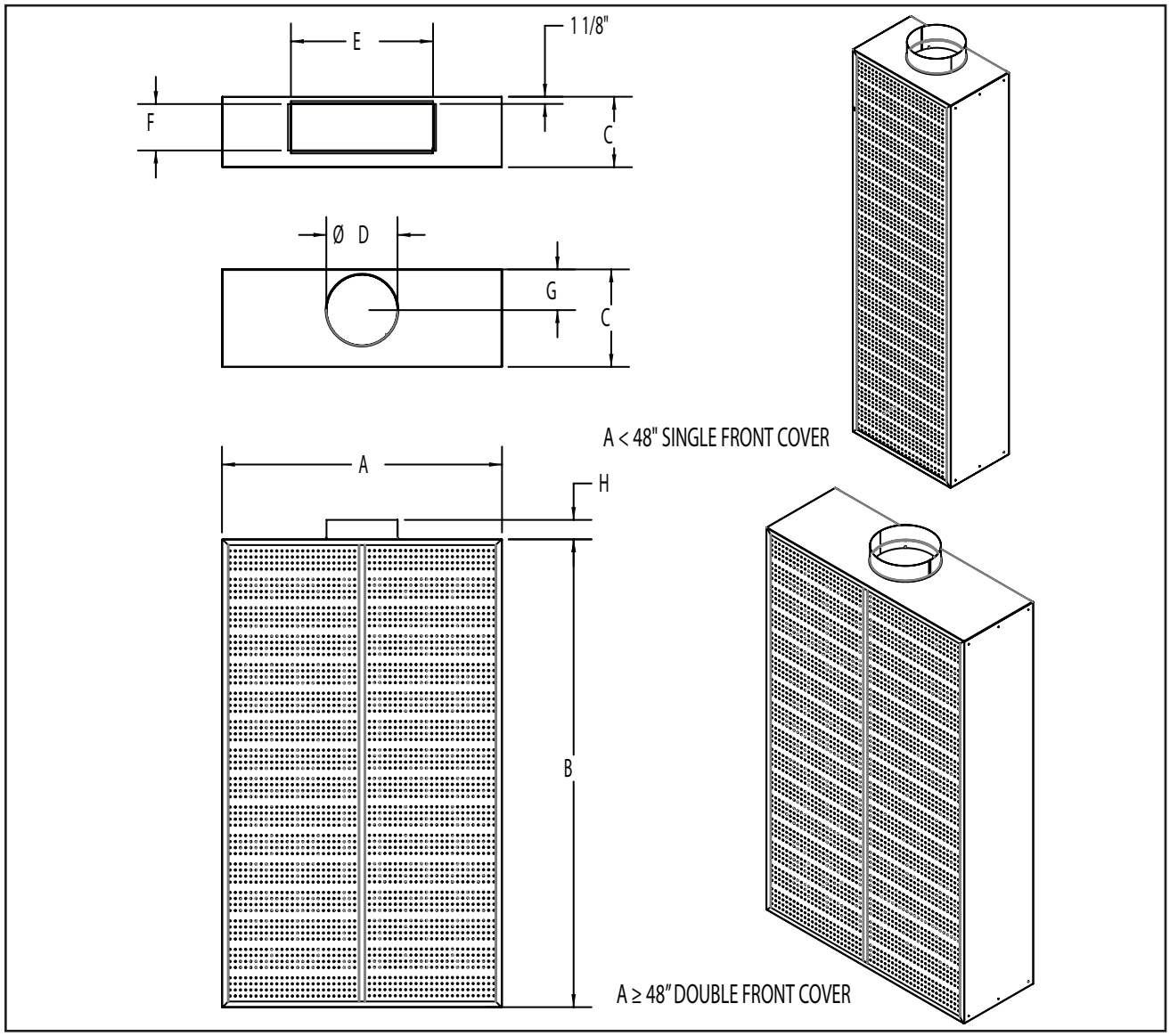
FINISHES

Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

OVERVIEW

The DVRI is a rectangular displacement diffuser that can be positioned against the wall in a flush or surface mount orientation. It has a one-way air distribution pattern and supplies a large volume of air air at low velocities into the occupied zone. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.

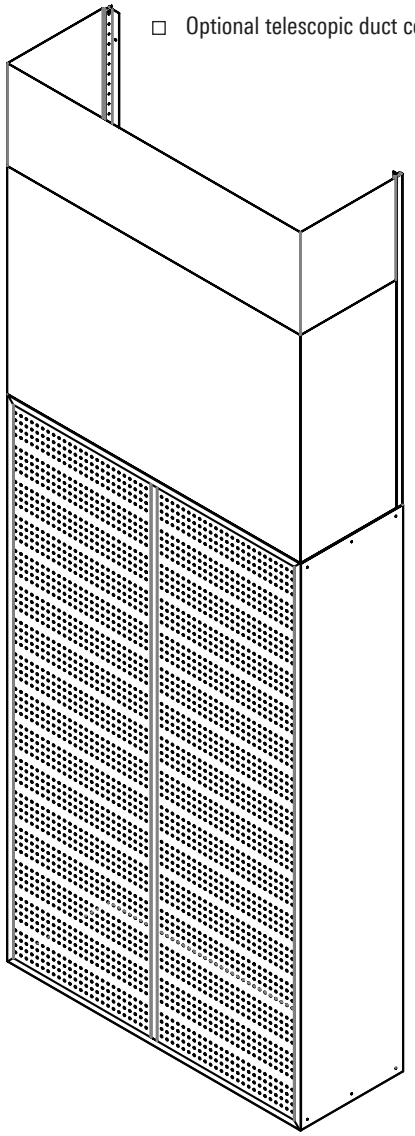
DVRI UNIT DIMENSIONS

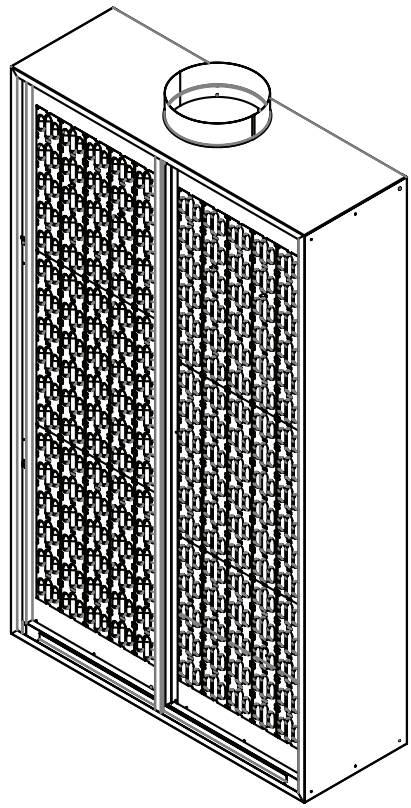


Model	Inlet Size	Nominal Unit Size	Dimensions (inches)							
			A	B	C	D	E	F	G	H
DVRI	8	24 x 24	23¼	46 7/8	11 13/16	7 7/8	N/A	N/A	4 1/2	3 1/4
	8	24 x 47	24	24	11 13/16	7 7/8	N/A	N/A	4 1/2	3 1/4
	8	24 x 48	24	48	11 13/16	7 7/8	N/A	N/A	4 1/2	3 1/4
	10	24 x 79	23¼	78 3/8	13 3/4	9 7/8	N/A	N/A	5 1/2	3 1/4
	10	36 x 48	36	48	13 3/4	9 7/8	N/A	N/A	5 1/2	3 1/4
	10	48 x 24	48	24	13 3/4	9 7/8	N/A	N/A	5 3/4	3 1/4
	10	48 x 36	48	36	13 3/4	9 7/8	N/A	N/A	5 3/4	3 1/4
	12	47 x 79	46 7/8	78 3/8	16 5/16	11 7/8	N/A	N/A	6 3/4	3 1/4
	12	60 x 24	60	24	16 5/16	11 7/8	N/A	N/A	7 1/16	3 1/4
	16	47 x 79	46 7/8	78 3/8	19 11/16	15 7/8	N/A	N/A	8 7/16	3 1/4
	16	60 x 36	60	36	19 11/16	15 7/8	N/A	N/A	8 11/16	3 1/4
	32 (24 x 8)	47 x 79	46 7/8	78 3/8	11 13/16	N/A	23 7/8	7 7/8	N/A	2
	42 (32 x 10)	47 x 79	46 7/8	78 3/8	13 3/4	N/A	31 7/8	9 7/8	N/A	2

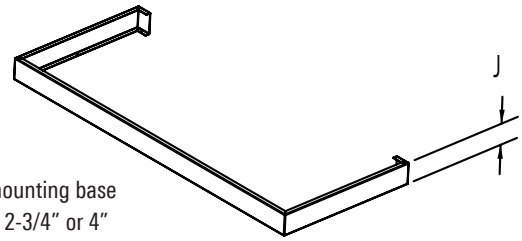
All dimensions are in inches

☐ Optional telescopic duct cover





View with face removed showing integral variable air pattern controllers



☐ Optional mounting base
Height (J): 2-3/4" or 4"

Model	Unit Size	Diffuser height with duct cover kit*	
		Min	Max
DVRI	24 x 24	92	124"
	24 x 47	70½	
	24 x 48	92	
	24 x 79	109 7/8	
	36 x 48	92	
	48 x 24	70½	
	48 x 36	82 4/8	
	47 x 79	109 7/8	
	60 x 24	70 4/8	
	60 x 36	82½	

*Height dimensions do not include mounting base

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

All dimensions are in inches

DVRI

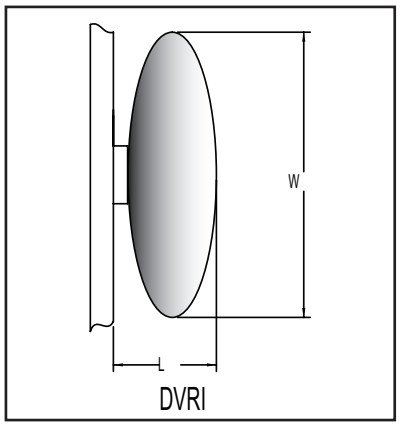
Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
24" x 24"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.008	0.017	0.030	0.047	0.068	0.093	0.122
		NC (Noise Criteria)	-	-	-	-	-	11	16
		Adjacent Zone (AZ) Δ5°	4-4	5-6	5-8	6-9	6-11	7-12	7-14
		Adjacent Zone (AZ) Δ10°	4-4	5-6	6-8	7-9	7-11	8-13	8-15
24" x 48"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.004	0.008	0.014	0.023	0.033	0.044	0.058
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	4-4	5-6	5-8	6-9	6-11	7-12	7-14
		Adjacent Zone (AZ) Δ10°	4-4	5-6	6-8	7-9	7-11	8-13	8-15
24" x 79"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.003	0.008	0.014	0.022	0.032	0.043	0.056
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	5-6	6-9	6-12	7-14	8-17	8-19	9-22
		Adjacent Zone (AZ) Δ10°	5-6	6-9	7-12	8-15	9-17	9-20	10-22
36" x 48"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.008	0.014	0.022	0.032	0.044	0.057
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	5-4	6-6	7-8	8-10	9-12	9-14	10-16
		Adjacent Zone (AZ) Δ10°	6-5	7-7	8-9	9-10	10-12	10-14	11-16
47" x 79"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.039	0.051
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	7-5	8-7	9-9	10-12	11-14	12-16	13-18
		Adjacent Zone (AZ) Δ10°	8-5	9-8	10-10	12-12	12-14	13-16	14-18
47" x 79"	24" x 8"	Airflow, cfm	261	392	522	653	783	914	1045
		Total Pressure	0.004	0.009	0.015	0.024	0.034	0.047	0.061
		NC (Noise Criteria)	-	-	-	-	-	-	14
		Adjacent Zone (AZ) Δ5°	9-8	10-12	12-15	13-19	14-22	15-25	16-29
		Adjacent Zone (AZ) Δ10°	10-8	12-12	13-16	14-19	16-23	17-26	18-29
48" x 24"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.006	0.013	0.023	0.036	0.052	0.071	0.092
		NC (Noise Criteria)	-	-	-	-	-	11	15
		Adjacent Zone (AZ) Δ5°	6-4	7-5	8-7	9-8	10-10	10-11	11-12
		Adjacent Zone (AZ) Δ10°	7-4	8-5	9-7	10-8	11-10	11-11	12-13
48" x 36"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.009	0.015	0.024	0.034	0.047	0.061
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	6-4	7-5	8-7	9-8	10-10	10-11	11-12
		Adjacent Zone (AZ) Δ10°	7-4	8-5	9-7	10-8	11-10	11-11	12-13

DVRI (continued)

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
60" x 24"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.007	0.016	0.028	0.044	0.064	0.087	0.113
		NC (Noise Criteria)	-	-	-	-	11	16	20
		Adjacent Zone (AZ) Δ5°	7-4	9-6	10-8	11-10	12-11	13-13	14-15
		Adjacent Zone (AZ) Δ10°	8-4	10-6	11-8	12-10	13-12	14-13	15-15
60" x 36"	16" Dia.	Airflow, cfm	275	412	550	687	825	962	1100
		Total Pressure	0.007	0.016	0.029	0.045	0.066	0.089	0.117
		NC (Noise Criteria)	-	-	-	-	15	20	24
		Adjacent Zone (AZ) Δ5°	10-7	11-10	13-13	14-16	15-19	16-22	17-25
		Adjacent Zone (AZ) Δ10°	11-7	13-11	15-14	16-17	17-20	18-23	20-26

PERFORMANCE NOTES

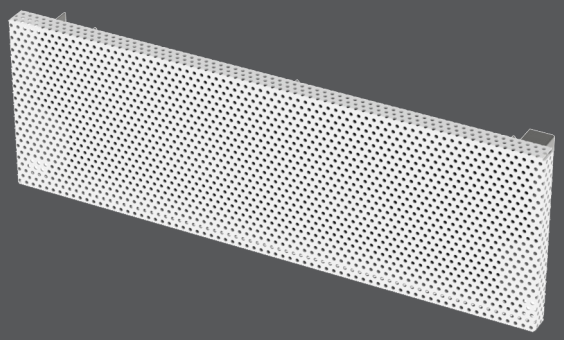
- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DVRI

DVR1

- Rectangular displacement diffuser with 1-way air discharge pattern for flush mount applications in the risers of steps or stairs
- Supplys air at low velocity into the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Optional finishes available - specify RAL code



DVR1

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

DVR1

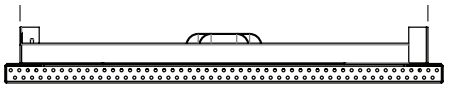
FINISHES

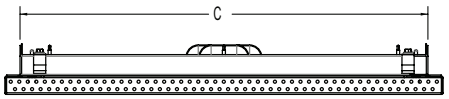
Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

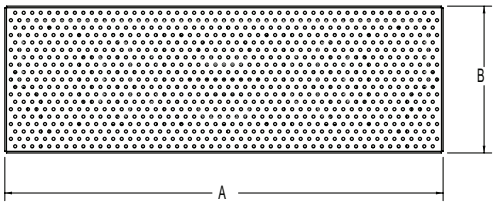
OVERVIEW

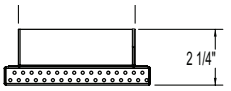
The DVR1 is a rectangular displacement diffuser with a one-way discharge pattern designed for stair riser applications. It supplies a large volume of air at low velocities into the occupied zone. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.

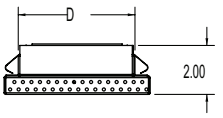
DVR1 UNIT DIMENSIONS

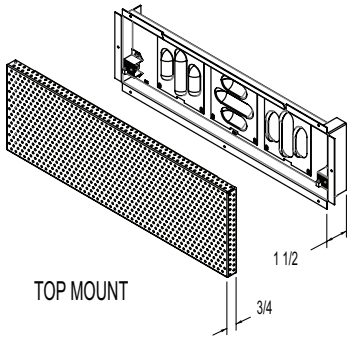


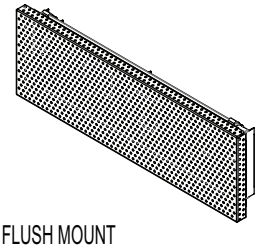




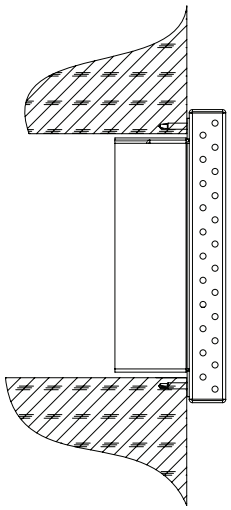


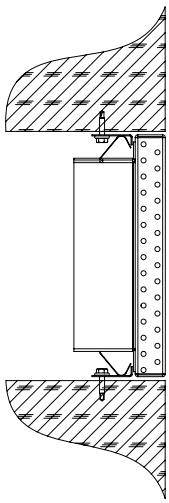






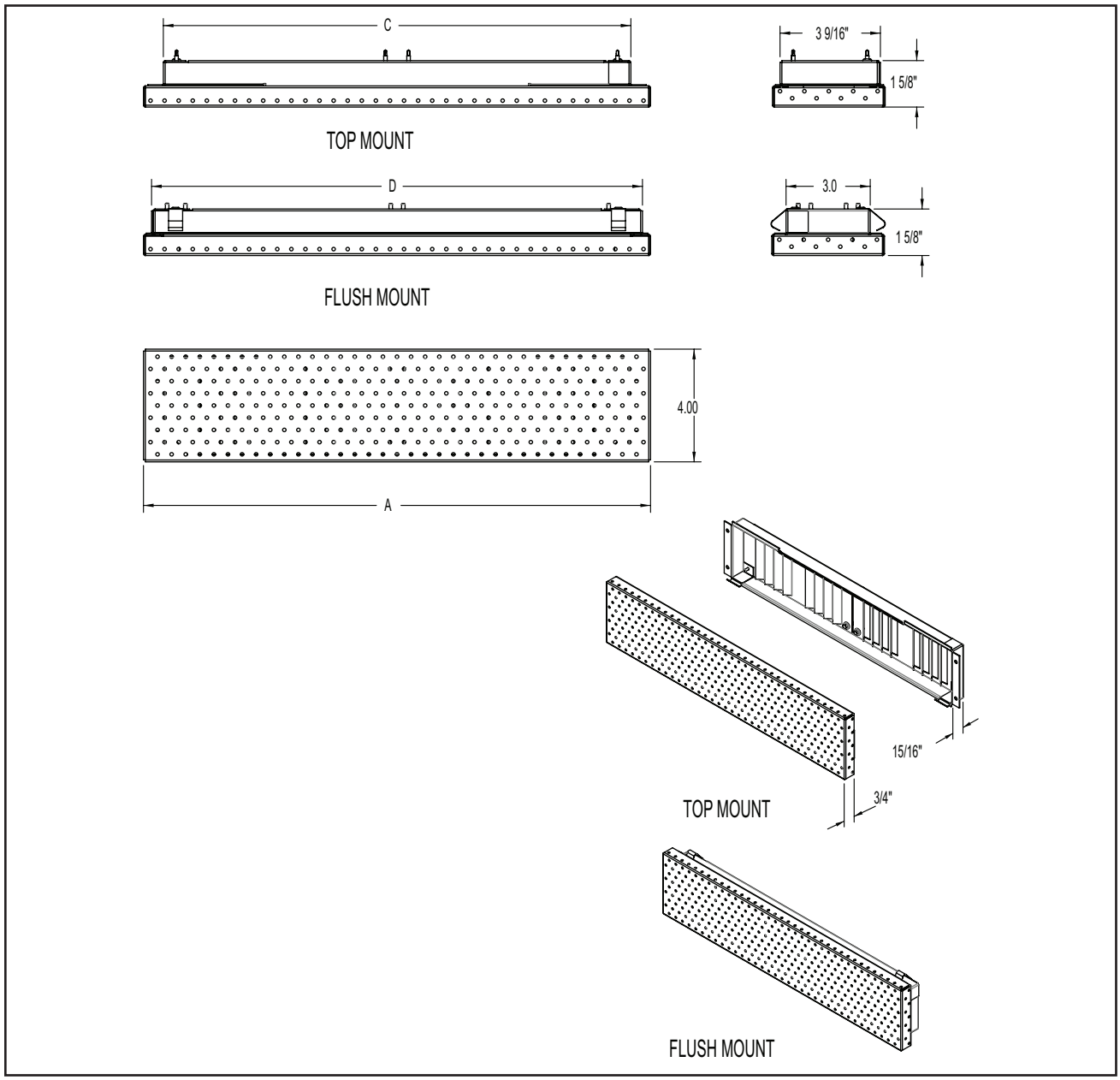
Model	Nominal Unit Size	Unit Dimensions (inches)			
		A	B	C	D
DVR1	6 x 18	6	18	16¾	4⅞
	12 x 12	12	12	10⅘	10¾
	18 x 6	18	6	4⅘	16¾
	18 x 8	18	8	6⅘	16¾
	18 x 12	18	12	10⅘	16¾
	24 x 6	24	6	4⅘	22¾
	24 x 8	24	8	6⅘	22¾
	24 x 12	24	12	10⅘	22¾
	24 x 24	24	24	22⅘	22¾
	24 x 30	24	30	28⅘	22¾
	24 x 36	24	36	34⅘	22¾
	24 x 48	24	48	46⅘	22¾
	30 x 6	30	6	4⅘	28¾
	30 x 8	30	8	6⅘	28¾
	30 x 24	30	24	22⅘	28¾
	36 x 6	36	6	4⅘	34¾
	36 x 8	36	8	6⅘	34¾
	36 x 24	36	24	22⅘	34¾
	40 x 6	40	6	4⅘	38¾
	40 x 8	40	8	6⅘	38¾
	48 x 6	48	6	4⅘	46¾
	48 x 8	48	8	6⅘	46¾
	48 x 24	48	24	22⅘	46¾
	60 x 8	60	8	6⅘	58¾





All dimensions are in inches

DVR1 (4") UNIT DIMENSIONS



Unit Size	A	C	D
18 x 4	18.00	16⅝	17½
24 x 4	24.00	22⅝	23½
30 x 4	30.00	28⅝	29½
36 x 4	36.00	34⅝	35½
40 x 4	40.00	38⅝	39½
48 x 4	48.00	46⅝	47½

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

All dimensions are in inches

DVR1

Nominal Unit Size 18" x 4"	Plenum pressure	0.005	0.010	0.015	0.020	0.025	0.030	0.040	0.050
	Airflow, cfm	25	35	43	50	56	61	70	78
	NC (Noise Criteria)	-	-	-	-	-	-	-	-
	Adjacent Zone (AZ) Δ5°	2-4	2-5	3-6	3-6	3-7	3-7	3-8	4-8
	Adjacent Zone (AZ) Δ10°	2-5	3-6	3-7	3-8	3-8	4-9	4-9	4-10
Nominal Unit Size 24" x 4"	Plenum pressure	0.005	0.010	0.015	0.020	0.025	0.030	0.040	0.050
	Airflow, cfm	29	42	51	59	66	72	83	93
	NC (Noise Criteria)	-	-	-	-	-	-	-	-
	Adjacent Zone (AZ) Δ5°	2-5	3-6	3-7	3-7	3-8	4-8	4-9	4-9
	Adjacent Zone (AZ) Δ10°	2-6	3-7	3-8	4-9	4-9	4-10	4-11	5-11
Nominal Unit Size 30" x 4"	Plenum pressure	0.005	0.010	0.015	0.020	0.025	0.030	0.040	0.050
	Airflow, cfm	46	65	80	92	103	113	130	145
	NC (Noise Criteria)	-	-	-	-	15	17	21	23
	Adjacent Zone (AZ) Δ5°	3-7	3-8	4-9	4-10	4-10	5-11	5-12	5-12
	Adjacent Zone (AZ) Δ10°	3-8	4-9	4-11	5-12	5-12	5-13	6-14	6-15
Nominal Unit Size 36" x 4"	Plenum pressure	0.005	0.010	0.015	0.020	0.025	0.030	0.040	0.050
	Airflow, cfm	50	70	86	99	111	122	140	157
	NC (Noise Criteria)	-	-	-	-	-	15	18	21
	Adjacent Zone (AZ) Δ5°	3-7	4-8	4-10	4-10	5-11	5-12	5-13	6-13
	Adjacent Zone (AZ) Δ10°	3-8	4-10	5-11	5-12	5-13	6-14	6-15	7-16
Nominal Unit Size 40" x 4"	Plenum pressure	0.005	0.010	0.015	0.020	0.025	0.030	0.040	0.050
	Airflow, cfm	49	69	85	98	110	120	139	155
	NC (Noise Criteria)	-	-	-	-	-	-	15	18
	Adjacent Zone (AZ) Δ5°	3-7	4-9	4-10	4-10	5-11	5-12	5-13	6-13
	Adjacent Zone (AZ) Δ10°	3-8	4-10	5-11	5-12	5-13	6-14	6-15	7-16
Nominal Unit Size 48" x 4"	Plenum pressure	0.005	0.010	0.015	0.020	0.025	0.030	0.040	0.050
	Airflow, cfm	59	83	102	118	132	144	166	186
	NC (Noise Criteria)	-	-	-	-	-	-	17	19
	Adjacent Zone (AZ) Δ5°	3-8	4-10	5-11	5-12	5-13	6-13	6-14	6-15
	Adjacent Zone (AZ) Δ10°	4-10	5-12	5-13	6-14	6-15	6-16	7-17	7-18
Nominal Unit Size 18" x 6"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	22	31	37	43	48	53	61	68
	NC (Noise Criteria)	-	-	-	-	-	15	20	23
	Adjacent Zone (AZ) Δ5°	1-6	1-7	2-8	2-9	2-10	2-11	2-12	3-13
	Adjacent Zone (AZ) Δ10°	1-6	2-8	2-9	2-10	2-10	3-11	3-12	3-13
Nominal Unit Size 24" x 6"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	35	49	60	70	78	85	99	110
	NC (Noise Criteria)	-	-	-	-	-	16	21	24
	Adjacent Zone (AZ) Δ5°	1-8	2-9	2-11	2-12	3-13	3-14	3-15	3-16
	Adjacent Zone (AZ) Δ10°	2-8	2-10	3-11	3-12	3-13	3-14	4-16	4-17
Nominal Unit Size 30" x 6"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	42	60	73	84	94	103	119	133
	NC (Noise Criteria)	-	-	-	-	-	17	22	25
	Adjacent Zone (AZ) Δ5°	2-8	2-10	2-12	3-13	3-14	3-14	3-16	4-17
	Adjacent Zone (AZ) Δ10°	2-8	2-11	3-12	3-13	3-14	4-15	4-17	4-18
Nominal Unit Size 36" x 6"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	43	61	75	86	97	106	122	137
	NC (Noise Criteria)	-	-	-	-	15	18	23	26
	Adjacent Zone (AZ) Δ5°	1-8	2-10	2-11	3-12	3-13	3-14	3-15	4-17
	Adjacent Zone (AZ) Δ10°	2-8	2-10	3-12	3-13	3-14	3-15	4-16	4-17
40" x 6"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	56	79	97	112	126	138	159	178
	NC (Noise Criteria)	-	-	-	-	16	19	23	26
	Adjacent Zone (AZ) Δ5°	2-9	2-11	3-13	3-14	3-15	3-16	4-18	4-19
	Adjacent Zone (AZ) Δ10°	2-9	3-12	3-13	3-15	4-16	4-17	4-19	5-20

DVR1 (continued)

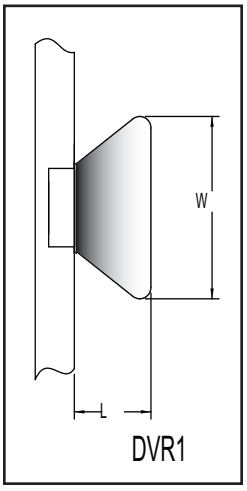
Nominal Unit Size 48" x 6"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	70	99	121	139	156	171	197	220
	NC (Noise Criteria)	-	-	-	-	16	19	24	27
	Adjacent Zone (AZ) Δ5°	2-10	3-12	3-14	3-16	4-17	4-18	4-20	5-21
	Adjacent Zone (AZ) Δ10°	2-10	3-13	3-15	4-16	4-18	4-19	5-21	5-22
Nominal Unit Size 18" x 8"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	22	31	38	44	50	54	63	70
	NC (Noise Criteria)	-	-	-	-	-	16	21	24
	Adjacent Zone (AZ) Δ5°	1-6	1-7	2-9	2-9	2-10	2-11	3-12	3-13
	Adjacent Zone (AZ) Δ10°	1-6	2-8	2-9	2-10	2-11	3-11	3-12	3-13
Nominal Unit Size 24" x 8"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	36	51	63	72	81	89	102	115
	NC (Noise Criteria)	-	-	-	-	-	18	22	26
	Adjacent Zone (AZ) Δ5°	1-8	2-10	2-11	3-12	3-13	3-14	3-15	4-17
	Adjacent Zone (AZ) Δ10°	2-8	2-10	3-12	3-13	3-14	3-15	4-16	4-17
Nominal Unit Size 30" x 8"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	44	62	76	87	98	107	123	138
	NC (Noise Criteria)	-	-	-	-	16	18	23	26
	Adjacent Zone (AZ) Δ5°	2-8	2-10	2-12	3-13	3-14	3-15	4-16	4-18
	Adjacent Zone (AZ) Δ10°	2-9	2-11	3-12	3-14	3-15	4-16	4-17	4-18
Nominal Unit Size 36" x 8"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	44	63	77	89	99	109	125	140
	NC (Noise Criteria)	-	-	-	-	16	19	23	27
	Adjacent Zone (AZ) Δ5°	1-8	2-10	2-11	3-13	3-13	3-14	3-16	4-17
	Adjacent Zone (AZ) Δ10°	2-8	2-10	3-12	3-13	3-14	3-15	4-16	4-18
Nominal Unit Size 40" x 8"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	58	82	101	116	130	143	165	184
	NC (Noise Criteria)	-	-	-	-	17	20	24	28
	Adjacent Zone (AZ) Δ5°	2-9	2-12	3-13	3-15	3-16	4-17	4-18	4-20
	Adjacent Zone (AZ) Δ10°	2-10	3-12	3-14	3-15	4-16	4-17	5-19	5-21
Nominal Unit Size 48" x 8"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	72	102	126	145	162	178	205	229
	NC (Noise Criteria)	-	-	-	-	18	20	25	28
	Adjacent Zone (AZ) Δ5°	2-10	3-13	3-15	3-16	4-17	4-18	4-20	5-22
	Adjacent Zone (AZ) Δ10°	2-11	3-13	3-15	4-17	4-18	5-19	5-21	6-23
Nominal Unit Size 60" x 8"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	87	123	151	175	195	214	247	276
	NC (Noise Criteria)	-	-	-	-	18	21	26	29
	Adjacent Zone (AZ) Δ5°	2-11	3-14	3-16	4-17	4-18	4-20	5-22	5-23
	Adjacent Zone (AZ) Δ10°	2-11	3-14	4-16	4-18	5-19	5-20	5-23	6-24
Nominal Unit Size 12" x 12"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	29	41	50	58	64	71	81	91
	NC (Noise Criteria)	-	-	-	-	-	17	21	24
	Adjacent Zone (AZ) Δ5°	2-6	2-8	2-10	2-11	2-12	2-14	3-16	3-17
	Adjacent Zone (AZ) Δ10°	2-6	2-9	2-10	3-12	3-13	3-15	3-16	3-18
Nominal Unit Size 18" x 12"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	43	61	75	86	97	106	122	137
	NC (Noise Criteria)	-	-	-	-	15	18	23	26
	Adjacent Zone (AZ) Δ5°	2-6	2-8	3-10	3-12	3-13	3-14	4-16	4-18
	Adjacent Zone (AZ) Δ10°	2-6	3-9	3-11	3-12	4-14	4-15	4-17	4-19
Nominal Unit Size 24" x 12"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	70	99	121	139	156	171	197	220
	NC (Noise Criteria)	-	-	-	-	16	19	24	27
	Adjacent Zone (AZ) Δ5°	3-8	3-11	4-13	4-15	4-16	4-18	5-20	5-23
	Adjacent Zone (AZ) Δ10°	3-8	4-11	4-14	5-16	5-17	5-19	6-22	6-24

DVR1 (continued)

Nominal Unit Size 6" x 18"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	28	39	48	55	62	68	78	87
	NC (Noise Criteria)	-	-	-	-	-	15	20	23
	Adjacent Zone (AZ) Δ5°	1-10	2-14	2-17	2-19	2-21	2-23	2-27	2-30
	Adjacent Zone (AZ) Δ10°	2-11	2-15	2-18	2-20	2-23	2-25	3-28	3-31
Nominal Unit Size 24" x 24"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	167	236	288	333	372	408	471	527
	NC (Noise Criteria)	-	-	-	15	18	21	26	29
	Adjacent Zone (AZ) Δ5°	4-17	5-24	6-29	6-34	7-38	7-41	8-47	8-52
	Adjacent Zone (AZ) Δ10°	5-19	6-26	7-31	7-36	8-40	8-43	9-50	9-56
Nominal Unit Size 30" x 24"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	202	285	350	404	451	494	571	638
	NC (Noise Criteria)	-	-	-	16	20	22	27	30
	Adjacent Zone (AZ) Δ5°	5-17	6-24	7-29	7-34	8-38	8-41	9-47	9-52
	Adjacent Zone (AZ) Δ10°	6-18	7-26	8-31	9-36	9-40	10-43	10-50	11-55
Nominal Unit Size 36" x 24"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	209	296	362	418	468	512	592	661
	NC (Noise Criteria)	-	-	-	17	21	23	28	31
	Adjacent Zone (AZ) Δ5°	5-15	6-22	7-26	8-30	8-33	9-36	9-42	10-47
	Adjacent Zone (AZ) Δ10°	6-16	8-23	8-28	9-32	10-35	10-39	11-44	12-49
Nominal Unit Size 48" x 24"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	333	471	577	666	745	816	942	1053
	NC (Noise Criteria)	-	-	-	18	21	24	29	32
	Adjacent Zone (AZ) Δ5°	7-19	9-26	10-32	10-37	11-41	12-45	12-51	13-57
	Adjacent Zone (AZ) Δ10°	9-20	10-28	11-34	12-39	13-44	14-47	15-54	16-61
Nominal Unit Size 24" x 30"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	226	320	392	453	506	554	640	716
	NC (Noise Criteria)	-	-	-	15	19	22	26	30
	Adjacent Zone (AZ) Δ5°	5-23	6-33	7-39	7-45	8-50	8-55	9-63	9-70
	Adjacent Zone (AZ) Δ10°	6-25	7-34	8-42	9-48	9-53	10-58	10-67	11-74
Nominal Unit Size 24" x 36"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	262	371	454	524	586	642	741	829
	NC (Noise Criteria)	-	-	-	16	20	23	27	31
	Adjacent Zone (AZ) Δ5°	6-27	7-37	7-45	8-52	8-58	9-63	9-73	10-81
	Adjacent Zone (AZ) Δ10°	7-28	8-40	9-48	9-55	10-61	10-67	11-77	12-86
Nominal Unit Size 24" x 48"	Plenum pressure	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10
	Airflow, cfm	357	505	619	715	799	876	1011	1130
	NC (Noise Criteria)	-	-	-	17	21	24	28	32
	Adjacent Zone (AZ) Δ5°	7-36	8-50	9-61	9-70	10-78	10-85	11-98	12-109
	Adjacent Zone (AZ) Δ10°	8-38	9-53	10-65	11-74	12-83	12-90	13-104	14-115

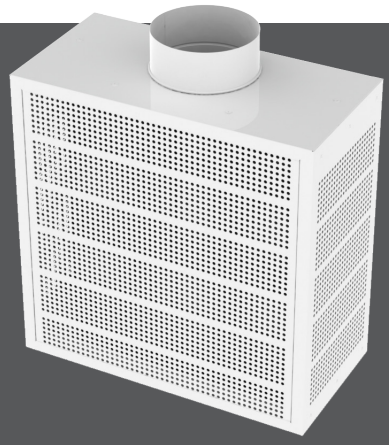
PERFORMANCE NOTES

- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DVR3

- Rectangular displacement diffuser with 3-way air discharge pattern for wall or surface mount applications
- Supplys a large volume of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Optional duct cover and mounting base available as accessories



DVR3

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

DVR3

FINISHES

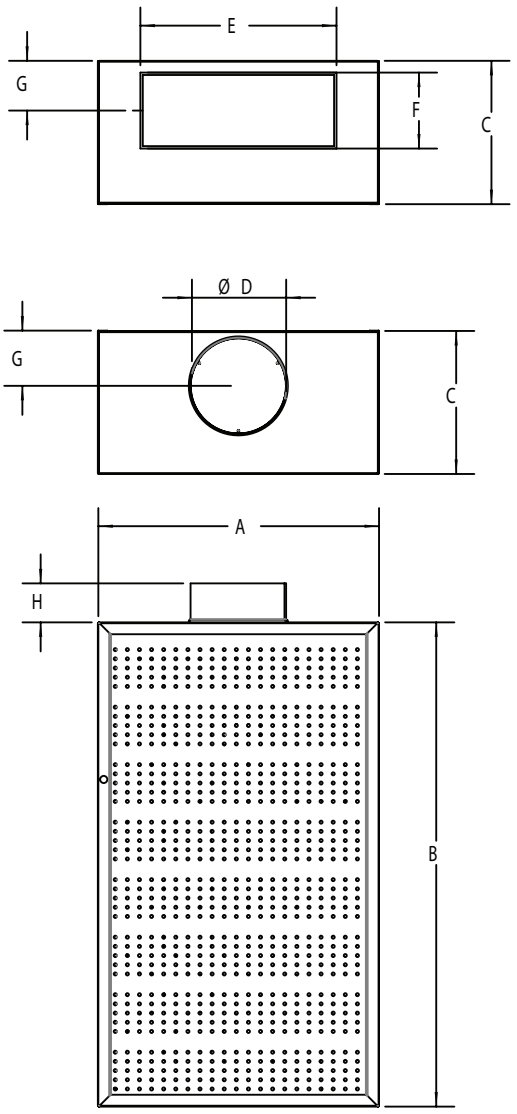
Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

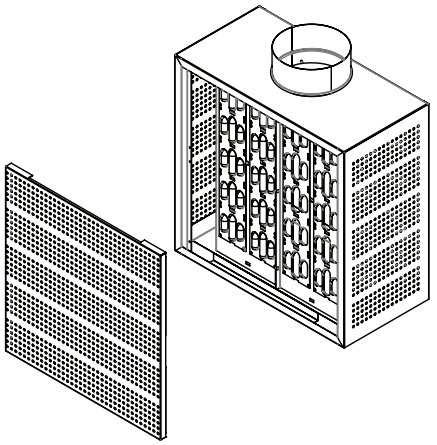
OVERVIEW

The DVR3 is a rectangular displacement diffuser with a three-way discharge pattern designed for flush mount applications. It supplies a large volume of air at low velocities into the occupied zone. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.

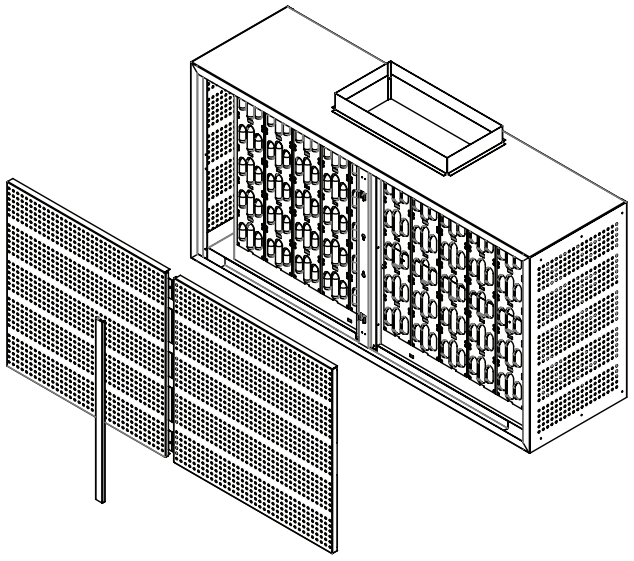
DVR3 installed in a training facility

DVR3 UNIT DIMENSIONS





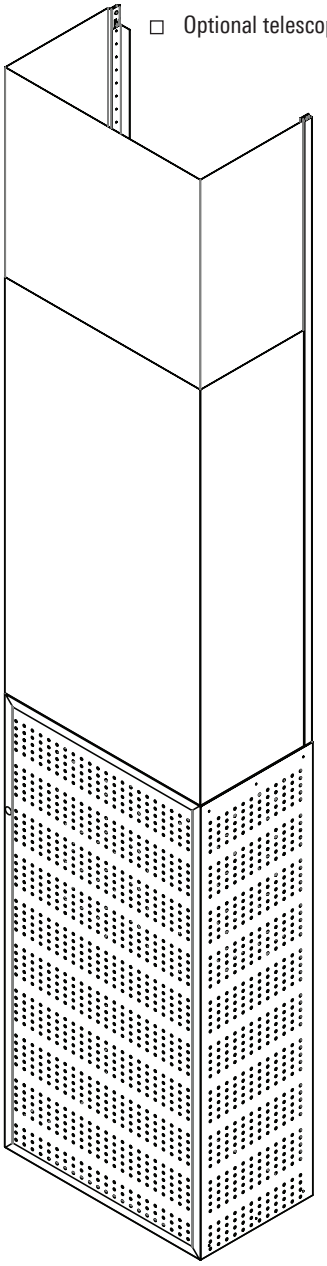
A < 48" SINGLE FRONT COVER



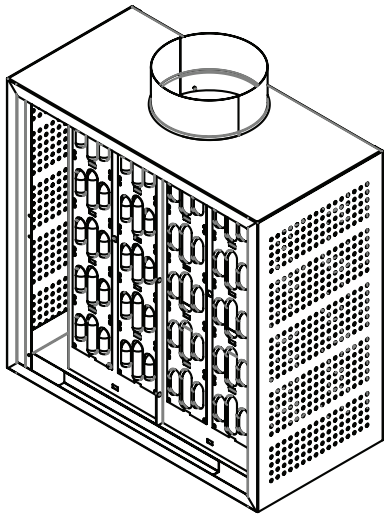
A ≥ 48" DOUBLE FRONT COVER

Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)							
			A	B	C	D	E	F	G	H
DVR3	8	24 x 24	24	24	12	7⅞	N/A	N/A	4½	3¼
	10	24 x 48	24	48	13¾	9⅞	N/A	N/A	5⅜	3¼
	10	24 x 60	24	60	13¾	9⅞	N/A	N/A	5⅜	3¼
	12	36 x 48	36	48	16¼	11⅞	N/A	N/A	6⅝	3¼
	12	36 x 60	36	60	16¼	11⅞	N/A	N/A	6⅝	3¼
	10	48 x 24	48	24	13¾	9⅞	N/A	N/A	5⅜	3¼
	12	48 x 36	48	36	16¼	11⅞	N/A	N/A	6⅝	3¼
	10	60 x 24	60	24	13¾	9⅞	N/A	N/A	5⅜	3¼
	12	60 x 24	60	36	16¼	11⅞	N/A	N/A	6⅝	3¼
	16 x 6	24 x 24	24	24	12	N/A	15⅞	5⅞	4⅜	2
	16 x 8	24 x 24	24	48	13¾	N/A	15⅞	7⅞	5⅜	2
	18 x 8	24 x 24	24	60	13¾	N/A	17⅞	7⅞	4⅞	2
	16 x 8	24 x 24	48	24	13¾	N/A	15⅞	7⅞	5⅜	2

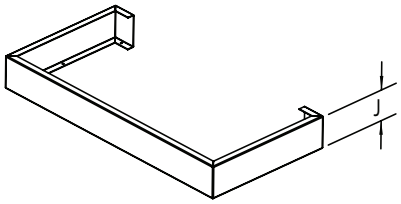
All dimensions are in inches



☐ Optional telescopic duct cover



View with face removed showing integral variable air pattern controllers



☐ Optional mounting base
Height (J): 2-3/4" or 4"

Unit Size	Diffuser height with duct cover kit*	
	Min	Max
24 x 24	70½	124
24 x 48	92	
24 x 60	92	
36 x 48	92	
36 x 60	92	
48 x 24	70½	
48 x 36	82½	
60 x 24	70½	
60 x 36	82½	

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

All dimensions are in inches

DVR3

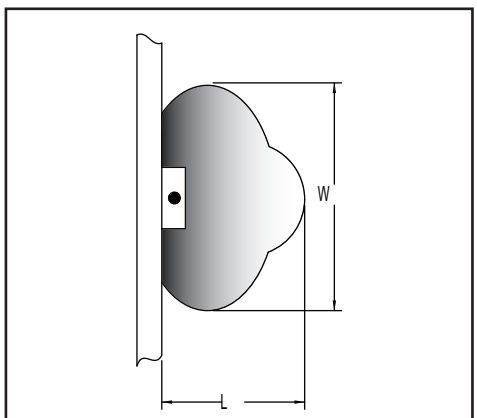
Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
24" x 24"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.005	0.011	0.020	0.032	0.046	0.063	0.082
		NC (Noise Criteria)	-	-	-	-	-	-	11
		Adjacent Zone (AZ) Δ5°	2-6	3-7	4-9	5-11	6-12	6-14	7-15
		Adjacent Zone (AZ) Δ10°	2-6	3-8	4-10	5-12	6-14	7-15	8-17
24" x 48"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.008	0.015	0.023	0.033	0.045	0.059
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-8	4-10	6-13	7-15	8-17	9-19	10-21
		Adjacent Zone (AZ) Δ10°	3-8	5-11	6-14	7-16	8-19	9-21	11-23
24" x 60"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.003	0.007	0.013	0.020	0.028	0.039	0.050
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-8	4-10	6-13	7-15	8-17	9-19	10-21
		Adjacent Zone (AZ) Δ10°	3-8	5-11	6-14	7-16	8-19	9-21	11-23
48" x 24"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.005	0.010	0.018	0.028	0.041	0.056	0.073
		NC (Noise Criteria)	-	-	-	-	-	-	11
		Adjacent Zone (AZ) Δ5°	2-7	3-9	4-11	5-13	6-15	7-16	8-18
		Adjacent Zone (AZ) Δ10°	3-7	4-10	5-12	6-14	6-16	7-18	8-20
60" x 24"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.009	0.016	0.025	0.036	0.049	0.064
		NC (Noise Criteria)	-	-	-	-	-	-	10
		Adjacent Zone (AZ) Δ5°	2-6	3-8	4-10	5-12	5-14	6-16	7-17
		Adjacent Zone (AZ) Δ10°	2-7	3-9	4-11	5-13	6-15	7-17	7-19
36" x 48"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.004	0.008	0.014	0.023	0.032	0.044	0.058
		NC (Noise Criteria)	-	-	-	-	-	-	10
		Adjacent Zone (AZ) Δ5°	3-9	5-12	6-15	7-17	9-20	10-22	11-25
		Adjacent Zone (AZ) Δ10°	4-10	5-13	7-16	8-19	9-22	11-25	12-27
36" x 60"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.003	0.007	0.012	0.019	0.028	0.038	0.049
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-9	5-12	6-15	7-17	9-20	10-22	11-25
		Adjacent Zone (AZ) Δ10°	4-10	5-13	7-16	8-19	9-22	11-25	12-27
48" x 36"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.004	0.008	0.015	0.023	0.033	0.045	0.059
		NC (Noise Criteria)	-	-	-	-	-	-	10
		Adjacent Zone (AZ) Δ5°	3-8	4-11	6-14	7-17	8-19	9-21	10-23
		Adjacent Zone (AZ) Δ10°	3-9	5-13	6-15	7-18	8-21	10-23	11-26
60" x 36"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.006	0.013	0.024	0.037	0.053	0.073	0.095
		NC (Noise Criteria)	-	-	-	-	-	12	16
		Adjacent Zone (AZ) Δ5°	3-8	4-11	5-13	6-16	7-18	8-20	9-22
		Adjacent Zone (AZ) Δ10°	3-9	4-12	5-15	7-17	8-20	9-22	10-24

DVR3 (continued)

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
24" x 24"	16" x 6"	Airflow, cfm	130	194	259	324	389	453	518
		Total Pressure	0.013	0.029	0.051	0.080	0.115	0.156	0.204
		NC (Noise Criteria)	-	-	-	-	13	18	22
		Adjacent Zone (AZ) Δ5°	4-9	5-12	7-15	8-18	10-20	11-23	12-25
		Adjacent Zone (AZ) Δ10°	4-10	6-13	7-16	9-19	10-22	12-25	13-27
24" x 48"	16" x 8"	Airflow, cfm	174	260	347	434	521	608	695
		Total Pressure	0.006	0.014	0.025	0.038	0.055	0.075	0.098
		NC (Noise Criteria)	-	-	-	-	-	13	17
		Adjacent Zone (AZ) Δ5°	5-11	7-15	8-18	10-21	12-24	13-27	15-30
		Adjacent Zone (AZ) Δ10°	5-12	7-16	9-20	11-23	13-27	14-30	16-33
24" x 60"	18" x 8"	Airflow, cfm	196	293	391	489	587	684	782
		Total Pressure	0.005	0.012	0.021	0.033	0.048	0.065	0.085
		NC (Noise Criteria)	-	-	-	-	-	12	16
		Adjacent Zone (AZ) Δ5°	5-12	7-16	9-20	11-23	13-26	15-30	17-33
		Adjacent Zone (AZ) Δ10°	5-13	8-18	10-22	12-26	14-29	16-33	18-36
48" x 24"	16" x 8"	Airflow, cfm	174	260	347	434	521	608	695
		Total Pressure	0.008	0.019	0.034	0.052	0.076	0.103	0.135
		NC (Noise Criteria)	-	-	-	-	11	16	20
		Adjacent Zone (AZ) Δ5°	4-9	5-13	6-16	8-18	9-21	10-24	12-26
		Adjacent Zone (AZ) Δ10°	4-10	5-14	7-17	8-20	10-23	11-26	12-29

PERFORMANCE NOTES

- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



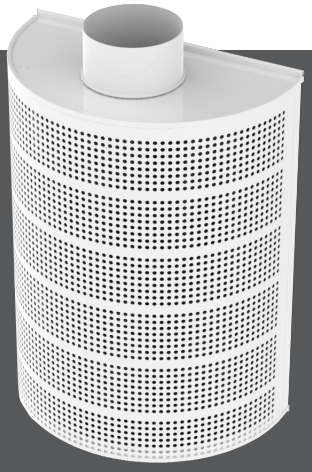
DVR3

Titus
Redefine your comfort zone.™

Semi-Circular Displacement

DV180

- Semi-circular displacement diffuser with 180° air discharge pattern for wall or surface mount applications
- Designed to supply a large volume of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Mounting base and telescopic duct cover available as accessories



DV180

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

DV180

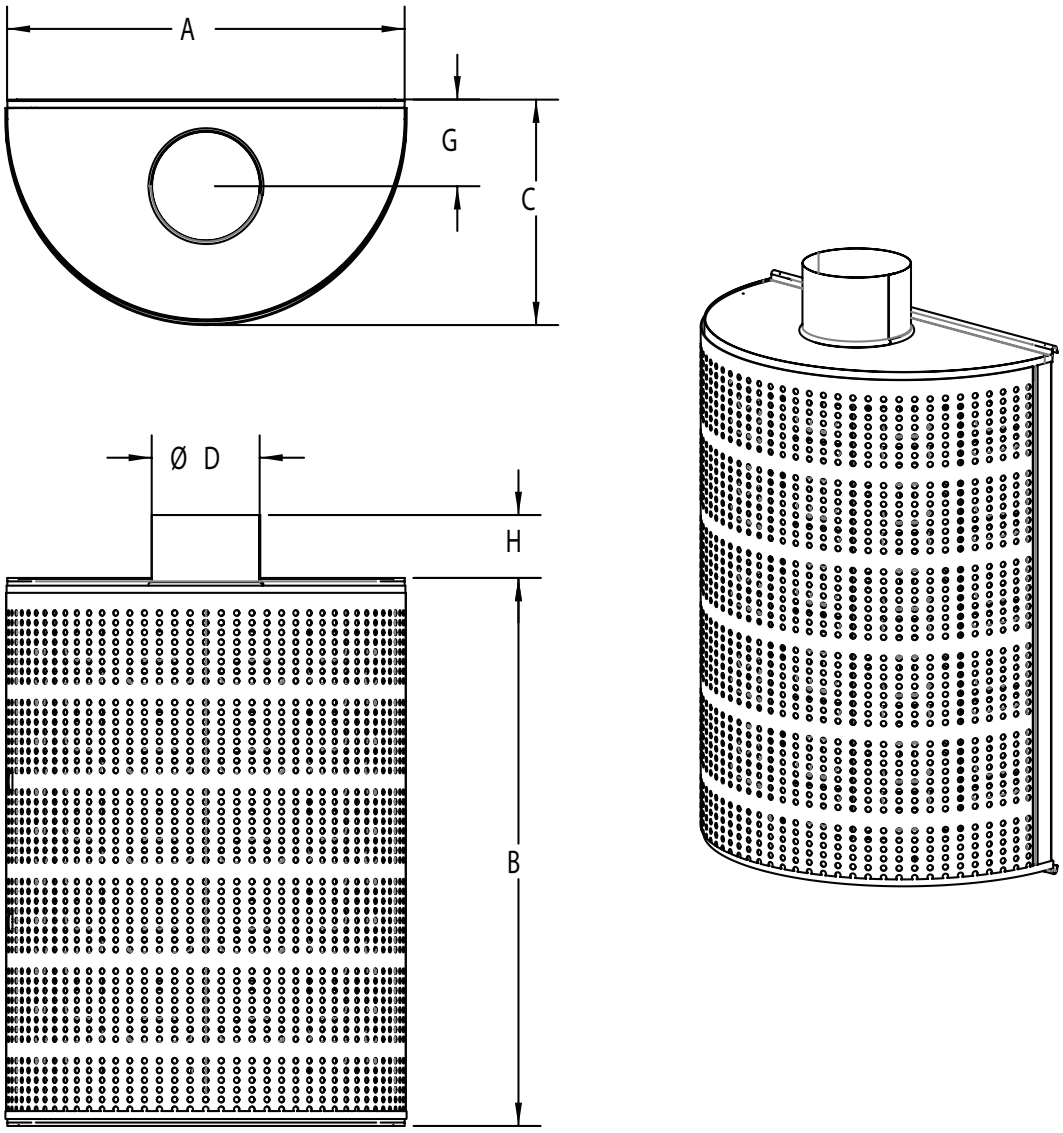
FINISHES

Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

OVERVIEW

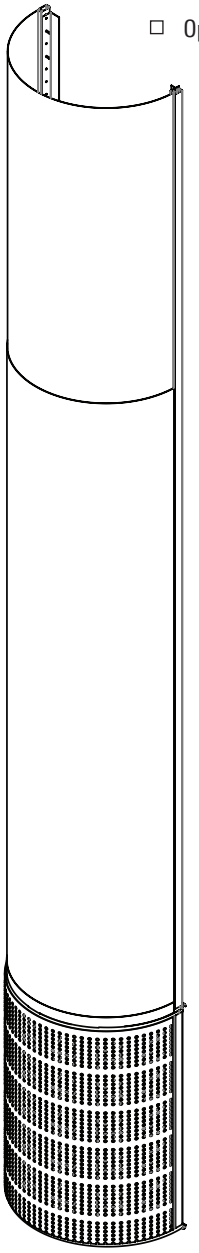
The DV180 is a semi-circular displacement diffuser with a 180 degree air discharge pattern. It is great for wall or surface mount applications and can be easily integrated into semi-circular building columns. The DV180 can supply a large volume of air at low velocity into the occupied zone. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.

DV180 UNIT DIMENSIONS



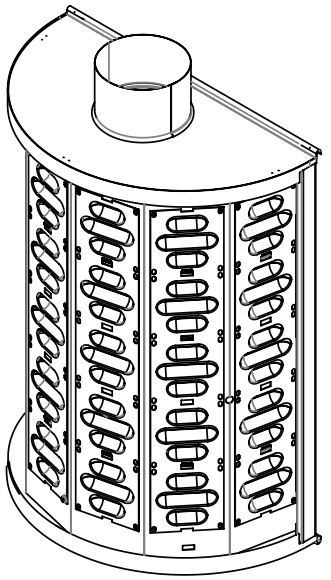
Model	Inlet Size	Nominal Unit Size	Dimensions (inches)					
			A	B	C	D	G	H
DV180	6	18 x 24	18	24	10 1/8	5 7/8	4 5/8	3 1/4
	8	24 x 24	24	24	13 1/8	7 7/8	5 7/8	3 1/4
	8	24 x 36	24	36	13 1/8	7 7/8	5 7/8	3 1/4
	10	24 x 48	24	48	13 1/8	9 7/8	6 1/6	3 1/4
	10	30 x 24	30	24	16 1/8	9 7/8	6 1/6	3 1/4
	10	30 x 36	30	36	16 1/8	9 7/8	7 1/8	3 1/4
	12	30 x 48	30	48	16 1/8	11 7/8	7 1/8	3 1/4
	12	30 x 60	30	60	16 1/8	11 7/8	7 5/8	3 1/4

All dimensions are in inches

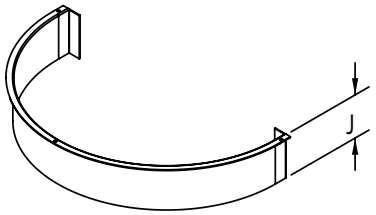


☐ Optional telescopic duct cover

Unit Size	Diffuser height with duct cover kit*	
	Min	Max
18x24	92	124
24x24	92	
24x36	84	
24x48	92	
30x24	72	118 7/16
30x36	77 5/8	124
30x48	92	
30x60	92	



View with face removed showing integral variable air pattern controllers



☐ Optional mounting base
Height (J): 2-3/4" or 4"

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

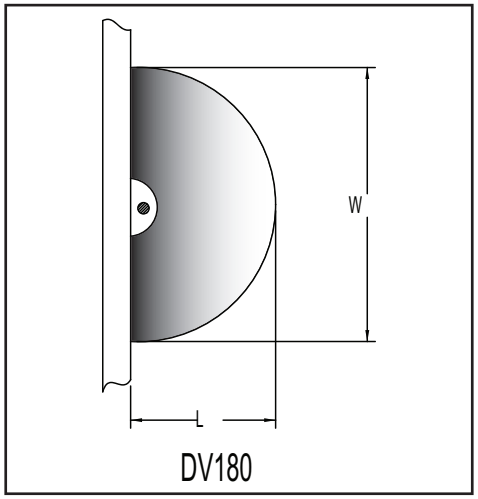
All dimensions are in inches

DV180

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
18″ x 24″	6″ Dia.	Airflow, cfm	38	56	75	94	113	132	151
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.040	0.052
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	2-4	3-6	3-6	4-8	4-8	4-8	5-10
		Adjacent Zone (AZ) Δ10°	2-4	3-6	4-8	4-8	5-10	5-10	6-12
24″ x 24″	8″ Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.004	0.008	0.014	0.022	0.032	0.043	0.057
		NC (Noise Criteria)	-	-	-	-	-	-	10
		Adjacent Zone (AZ) Δ5°	3-6	4-8	4-8	5-10	6-12	6-12	7-14
		Adjacent Zone (AZ) Δ10°	3-6	4-8	5-10	6-12	7-14	7-14	8-16
24″ x 36″	8″ Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.003	0.007	0.013	0.020	0.028	0.039	0.050
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-6	4-8	4-8	5-10	6-12	6-12	7-14
		Adjacent Zone (AZ) Δ10°	3-6	4-8	5-10	6-12	7-14	7-14	8-16
24″ x 48″	10″ Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.040	0.052
		NC (Noise Criteria)	-	-	-	-	-	-	12
		Adjacent Zone (AZ) Δ5°	4-8	5-10	6-12	7-14	8-16	8-16	9-18
		Adjacent Zone (AZ) Δ10°	4-8	6-12	7-14	8-16	9-18	10-20	10-20
30″ x 24″	10″ Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.009	0.016	0.024	0.035	0.048	0.062
		NC (Noise Criteria)	-	-	-	-	-	-	14
		Adjacent Zone (AZ) Δ5°	4-8	5-10	6-12	7-14	8-16	8-16	9-18
		Adjacent Zone (AZ) Δ10°	4-8	6-12	7-14	8-16	9-18	9-18	10-20
30″ x 36″	10″ Dia.	Airflow, cfm	160	213	266	319	425	532	638
		Total Pressure	0.007	0.013	0.021	0.030	0.053	0.082	0.119
		NC (Noise Criteria)	-	-	-	-	13	21	27
		Adjacent Zone (AZ) Δ5°	5-10	6-12	7-14	8-16	9-18	10-20	12-24
		Adjacent Zone (AZ) Δ10°	6-12	7-14	8-16	9-18	10-20	12-24	13-26
30″ x 48″	12″ Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.003	0.008	0.013	0.021	0.030	0.041	0.053
		NC (Noise Criteria)	-	-	-	-	-	11	15
		Adjacent Zone (AZ) Δ5°	5-10	6-12	7-14	8-16	10-20	10-20	11-22
		Adjacent Zone (AZ) Δ10°	5-10	7-14	8-16	10-20	11-22	12-24	13-26
30″ x 60″	12″ Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.039	0.051
		NC (Noise Criteria)	-	-	-	-	-	10	15
		Adjacent Zone (AZ) Δ5°	5-10	6-12	7-14	8-16	10-20	10-20	11-22
		Adjacent Zone (AZ) Δ10°	5-10	7-14	8-16	10-20	11-22	12-24	13-26

PERFORMANCE NOTES

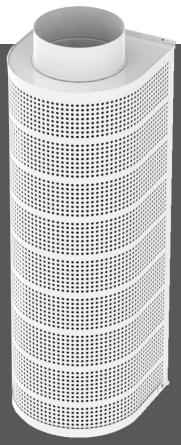
- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DV180

DVHC

- Semi-circular displacement diffuser with 180° air discharge pattern for wall or surface mount applications
- Designed to supply a large volume of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Mounting base and telescopic duct cover available as accessories



DVHC

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

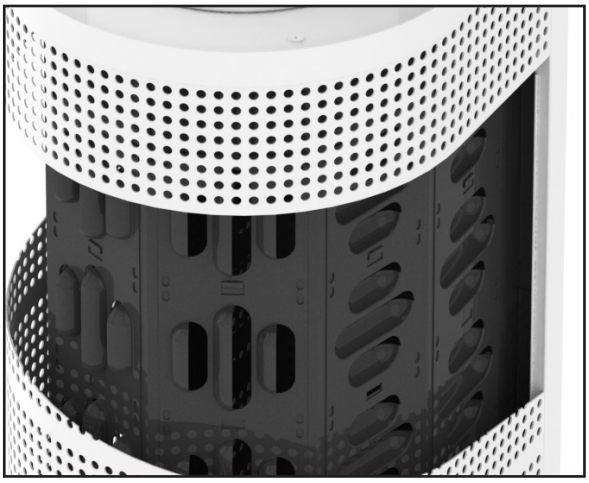
DVHC

FINISHES

Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

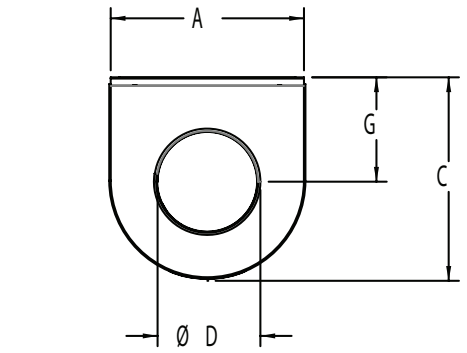
OVERVIEW

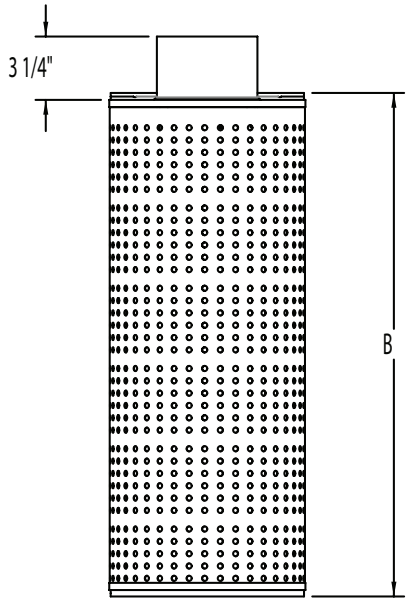
The DVHC is a semi-circular displacement diffuser with a 180 degree air discharge pattern. Utilizing the enhanced pattern controllers, it can supply a large volume of air at low velocity into the occupied zone. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.

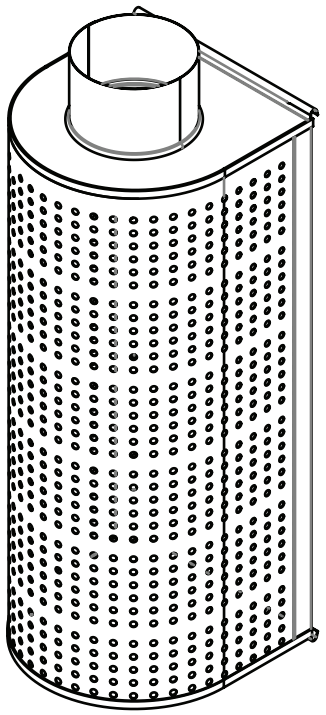


Cutaway of DVHC Diffuser

DVHC UNIT DIMENSIONS

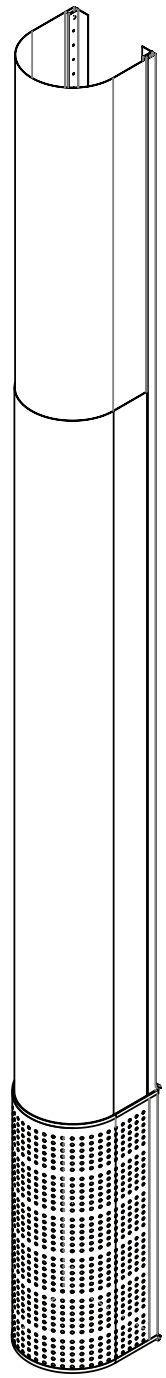






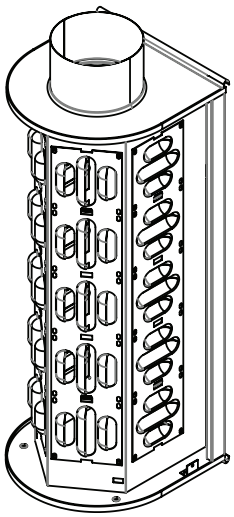
Model	Inlet Size	Nominal Unit Size	Dimensions (inches)				
			A	B	C	D	G
DVHC	5	10 x 25	9 5/8	24 1/2	9 9/16	4 7/8	4 13/16
	6	11 x 25	11	24 1/2	11	5 7/8	5 1/2
	8	13 x 37	12 9/16	36 5/16	12 1/2	7 7/8	6 5/16
	10	15 x 37	14 1/2	36 5/16	14 1/2	9 7/8	7 5/16
	12	18 x 60	17	60	17	11 7/8	8 9/16
	16	21 x 79	20 3/8	78 7/8	20 5/16	15 7/8	10 1/4
	12	24 x 24	24	24	24	19 7/8	11 15/16
	14	24 x 36	24	36	24	19 7/8	11 15/16
	16	24 x 48	24	48	24	19 7/8	11 15/16
	20	25 x 79	24 3/8	78 7/8	24 3/8	19 7/8	12 3/16
	24	30 x 79	29 1/2	78 7/8	29 1/2	23 7/8	14 3/4
	14	36 x 24	36	24	36	31 7/8	18 1/16
	16	36 x 36	36	36	36	31 7/8	18 1/16
	20	36 x 48	36	48	36	31 7/8	18 1/16
	32	37 x 79	36 1/4	78 7/8	36 3/16	31 7/8	18 1/8

All dimensions are in inches

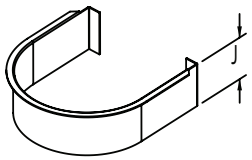


☐ Optional telescopic duct cover

DVHC Unit Size	Diffuser height with duct cover	
	Min	Max
10 x 26	92 1/8	124
11 x 26	92 1/8	
13 x 37	84 3/8	
15 x 37	84 3/8	
18 x 60	92 1/8	
21 x 79	109 7/8	
24 x 24	72	
24 x 36	84	
24 x 48	92 5/16	
25 x 79	109 7/8	
30 x 79	109 7/8	
36 x 24	72	
36 x 36	84	
36 x 48	92 5/16	
37 x 79	109 7/8	



View with face removed showing integral variable air pattern controllers



☐ Optional mounting base
Height (J): 2-3/4" or 4"

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

All dimensions are in inches

DVHC

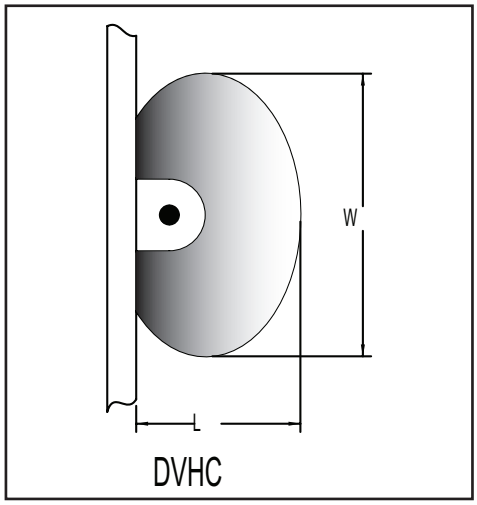
Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
11" x 25"	6" Dia.	Airflow, cfm	38	56	75	94	113	132	151
		Total Pressure	0.004	0.008	0.015	0.023	0.033	0.045	0.059
		NC (Noise Criteria)	-	-	-	-	-	-	11
		Adjacent Zone (AZ) Δ5°	3-8	3-10	4-12	4-13	5-15	5-16	5-18
		Adjacent Zone (AZ) Δ10°	4-9	4-11	5-13	5-15	6-17	6-19	6-21
13" x 37"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.004	0.008	0.015	0.023	0.033	0.045	0.059
		NC (Noise Criteria)	-	-	-	-	-	10	14
		Adjacent Zone (AZ) Δ5°	4-11	5-14	5-17	6-19	6-21	7-23	7-25
		Adjacent Zone (AZ) Δ10°	5-13	6-16	7-19	7-22	8-25	8-27	9-29
15" x 37"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.009	0.015	0.024	0.035	0.047	0.062
		NC (Noise Criteria)	-	-	-	-	-	13	17
		Adjacent Zone (AZ) Δ5°	5-14	6-18	7-22	8-25	8-28	9-31	9-33
		Adjacent Zone (AZ) Δ10°	7-17	8-21	9-26	9-29	10-33	11-36	11-39
18" x 60"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.004	0.008	0.015	0.023	0.033	0.045	0.058
		NC (Noise Criteria)	-	-	-	-	-	13	17
		Adjacent Zone (AZ) Δ5°	7-18	8-23	9-27	10-31	10-35	11-38	11-42
		Adjacent Zone (AZ) Δ10°	8-21	10-27	11-32	12-37	13-41	14-45	14-49
24" x 24"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.004	0.009	0.016	0.025	0.036	0.049	0.064
		NC (Noise Criteria)	-	-	-	-	10	15	19
		Adjacent Zone (AZ) Δ5°	8-18	9-23	10-27	11-31	12-35	13-39	14-42
		Adjacent Zone (AZ) Δ10°	10-21	12-27	13-32	14-37	15-41	16-45	17-49
24" x 36"	14" Dia.	Airflow, cfm	210	315	420	525	630	735	840
		Total Pressure	0.004	0.009	0.015	0.024	0.035	0.047	0.062
		NC (Noise Criteria)	-	-	-	-	11	16	20
		Adjacent Zone (AZ) Δ5°	9-22	11-28	12-33	13-38	14-42	15-47	16-50
		Adjacent Zone (AZ) Δ10°	11-25	13-33	15-39	16-44	17-50	18-54	19-59
24" x 48"	16" Dia.	Airflow, cfm	275	412	550	687	825	962	1100
		Total Pressure	0.004	0.009	0.015	0.024	0.035	0.047	0.061
		NC (Noise Criteria)	-	-	-	-	12	17	21
		Adjacent Zone (AZ) Δ5°	10-26	12-33	13-39	14-45	15-50	16-55	17-59
		Adjacent Zone (AZ) Δ10°	13-30	15-38	16-46	18-52	19-58	21-64	22-70

DVHC (continued)

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
36" x 24"	14" Dia.	Airflow, cfm	210	315	420	525	630	735	840
		Total Pressure	0.004	0.009	0.015	0.024	0.035	0.047	0.061
		NC (Noise Criteria)	-	-	-	-	11	16	20
		Adjacent Zone (AZ) Δ5°	11-22	13-28	15-33	16-38	17-43	19-47	20-51
		Adjacent Zone (AZ) Δ10°	14-26	17-33	19-39	20-45	22-50	23-55	25-59
36" x 36"	16" Dia.	Airflow, cfm	275	412	550	687	825	962	1100
		Total Pressure	0.004	0.008	0.015	0.023	0.034	0.046	0.060
		NC (Noise Criteria)	-	-	-	-	11	16	20
		Adjacent Zone (AZ) Δ5°	13-26	15-33	17-39	18-45	19-50	21-55	22-60
		Adjacent Zone (AZ) Δ10°	16-30	19-38	21-46	23-53	24-59	26-64	27-70

PERFORMANCE NOTES

- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water

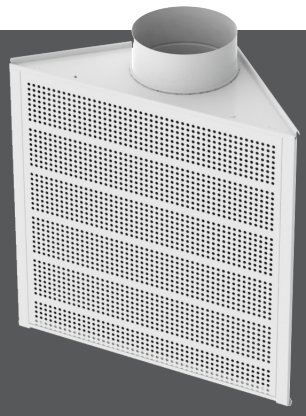


Titus
Redefine your comfort zone.™

Corner Mount Displacement

DVC1

- Flat face displacement diffuser with 90° air discharge pattern for corner mount applications
- Designed to supply a large volume of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Mounting base and telescopic duct cover available as accessories



DVC1

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

DVC1

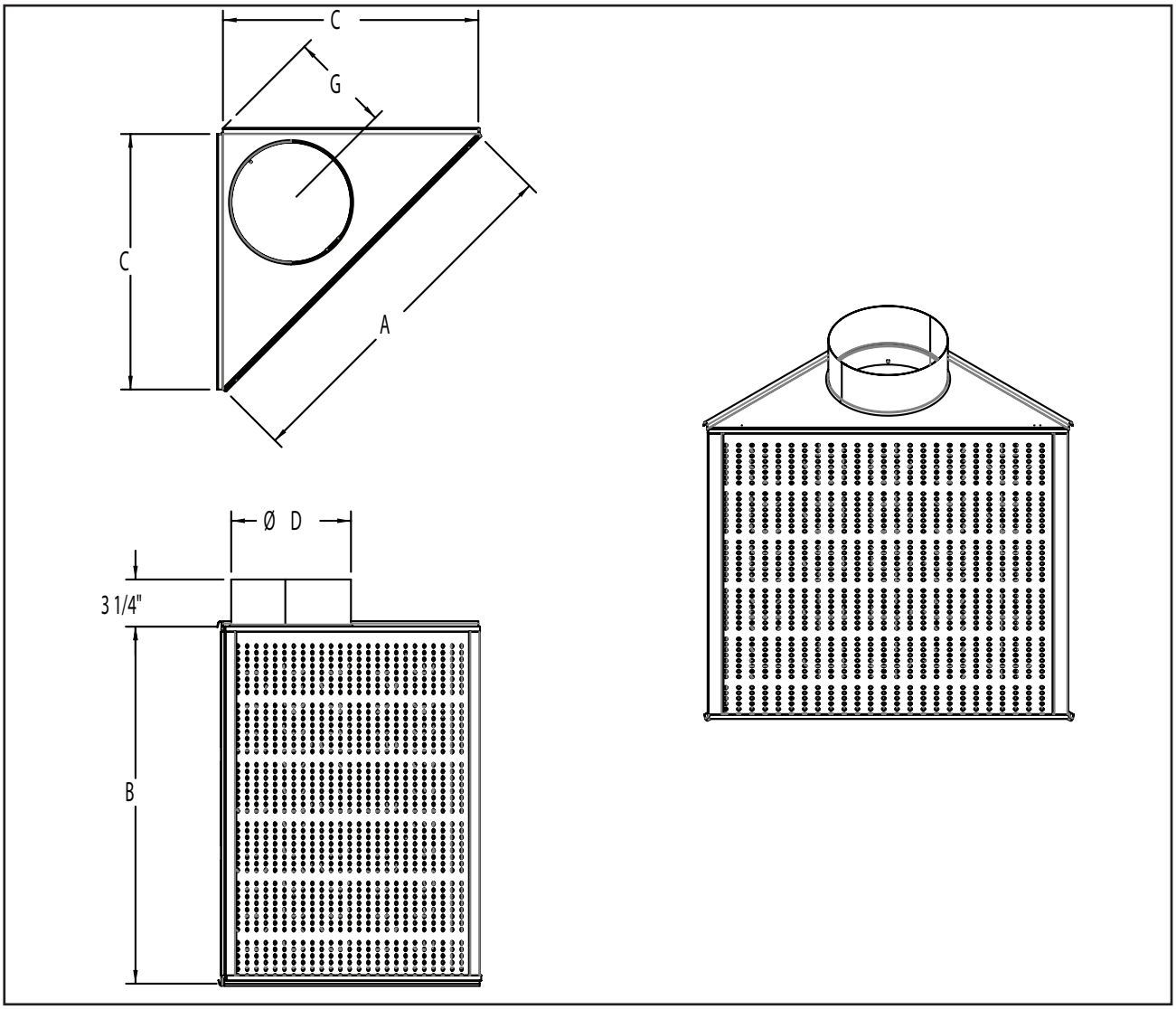
FINISHES

Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

OVERVIEW

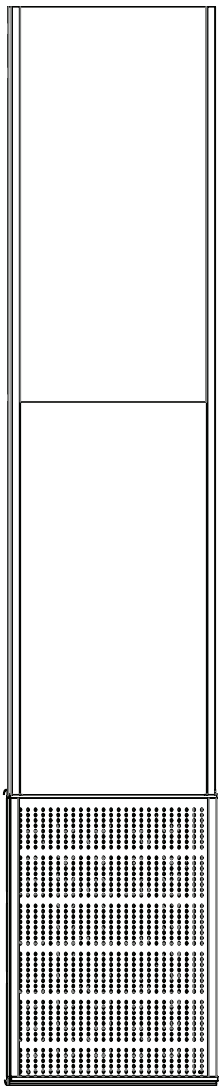
The DVC1 is a flat face corner mount displacement diffuser that is designed for corner mounted applications. The unit has a two-way air distribution pattern and easily adapts to different floor layouts. They supply a large volume of air at low velocity to the occupied zone by using newly enhanced pattern controllers. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.

DVC1 UNIT DIMENSIONS



Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)				
			A	B	C	D	G
DVC1	8	24 x 24	24	24	17	7 7/8	6 1/2
	8	24 x 36	24	36	17	7 7/8	6 1/2
	8	24 x 48	24	48	17	7 7/8	6 1/2
	8	24 x 60	24	60	17	7 7/8	6 1/2
	8	24 x 72	24	72	17	7 7/8	6 1/2
	8	30 x 24	30	24	20 5/8	7 7/8	8 1/4
	8	30 x 36	30	36	20 5/8	7 7/8	8 1/4
	8	30 x 48	30	48	20 5/8	7 7/8	8 1/4
	10	30 x 60	30	60	20 5/8	9 7/8	8 1/4
	10	30 x 72	30	72	20 5/8	9 7/8	8 1/4
	10	36 x 24	36	24	25 1/2	9 7/8	10 1/2
	10	36 x 36	36	36	25 1/2	9 7/8	10 1/2
	10	36 x 48	36	48	25 1/2	9 7/8	10 1/2
	12	36 x 60	36	60	25 1/2	11 7/8	10 1/2
	12	36 x 72	36	72	25 1/2	11 7/8	10 1/2

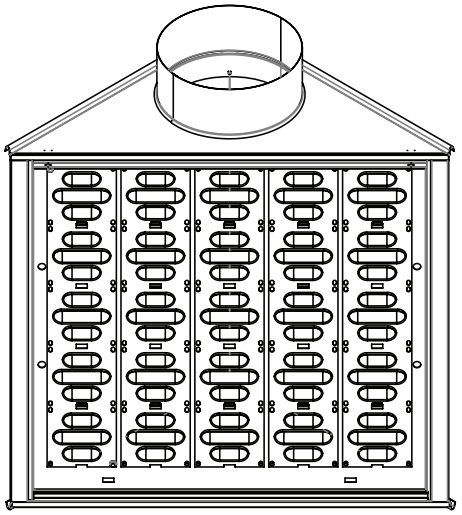
All dimensions are in inches



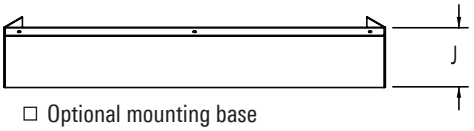
☐ Optional telescopic duct cover

Unit Size	Diffuser height with duct cover kit*	
	Min	Max
24 x 24	92	124
24 x 36		
24 x 48		
24 x 60		
24 x 72		
30 x 24		
30 x 36		
30 x 48		
30 x 60		
30 x 72		
36 x 24		
36 x 36		
36 x 48		
36 x 60		
36 x 72		

*Height dimensions do not include mounting base



View with face removed showing integral variable air pattern controllers



☐ Optional mounting base
Height (J): 2-3/4" or 4"

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

All dimensions are in inches

DVC1

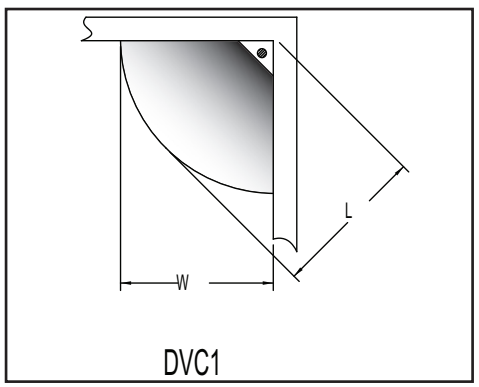
Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
24" x 24"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.004	0.010	0.018	0.027	0.040	0.054	0.070
		NC (Noise Criteria)	-	-	-	-	-	12	16
		Adjacent Zone (AZ) Δ5°	3-4	4-5	6-7	7-8	8-10	9-11	10-12
		Adjacent Zone (AZ) Δ10°	3-4	5-6	6-7	7-9	8-10	9-12	11-13
24" x 36"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.004	0.008	0.014	0.022	0.032	0.043	0.056
		NC (Noise Criteria)	-	-	-	-	-	-	12
		Adjacent Zone (AZ) Δ5°	3-4	4-5	6-7	7-8	8-10	9-11	10-12
		Adjacent Zone (AZ) Δ10°	3-4	5-6	6-7	7-9	8-10	9-12	11-13
24" x 48"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.040	0.052
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-4	4-5	6-7	7-8	8-10	9-11	10-12
		Adjacent Zone (AZ) Δ10°	3-4	5-6	6-7	7-9	8-10	9-12	11-13
24" x 60"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.003	0.007	0.013	0.020	0.028	0.039	0.050
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-4	4-5	6-7	7-8	8-10	9-11	10-12
		Adjacent Zone (AZ) Δ10°	3-4	5-6	6-7	7-9	8-10	9-12	11-13
24" x 72"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.003	0.007	0.012	0.019	0.028	0.038	0.049
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-4	4-5	6-7	7-8	8-10	9-11	10-12
		Adjacent Zone (AZ) Δ10°	3-4	5-6	6-7	7-9	8-10	9-12	11-13
30" x 24"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.004	0.009	0.016	0.025	0.036	0.049	0.063
		NC (Noise Criteria)	-	-	-	-	-	10	15
		Adjacent Zone (AZ) Δ5°	3-3	4-5	5-6	6-7	7-9	8-10	9-11
		Adjacent Zone (AZ) Δ10°	3-4	4-5	5-6	6-8	7-9	8-10	9-11
30" x 36"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.003	0.008	0.013	0.021	0.030	0.041	0.054
		NC (Noise Criteria)	-	-	-	-	-	-	10
		Adjacent Zone (AZ) Δ5°	3-3	4-5	5-6	6-7	7-9	8-10	9-11
		Adjacent Zone (AZ) Δ10°	3-4	4-5	5-6	6-8	7-9	8-10	9-11
30" x 48"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.039	0.051
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-3	4-5	5-6	6-7	7-9	8-10	9-11
		Adjacent Zone (AZ) Δ10°	3-4	4-5	5-6	6-8	7-9	8-10	9-11
30" x 60"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.040	0.052
		NC (Noise Criteria)	-	-	-	-	-	-	12
		Adjacent Zone (AZ) Δ5°	4-5	6-7	7-9	9-11	10-12	11-14	13-16
		Adjacent Zone (AZ) Δ10°	4-5	6-7	8-9	9-11	11-13	12-15	13-17

DVC1 (continued)

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
30" x 72"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.039	0.051
		NC (Noise Criteria)	-	-	-	-	-	-	10
		Adjacent Zone (AZ) Δ5°	4-5	6-7	7-9	9-11	10-12	11-14	13-16
		Adjacent Zone (AZ) Δ10°	4-5	6-7	8-9	9-11	11-13	12-15	13-17
36" x 24"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.010	0.017	0.027	0.039	0.053	0.070
		NC (Noise Criteria)	-	-	-	-	-	14	19
		Adjacent Zone (AZ) Δ5°	4-4	5-6	6-8	8-10	9-11	10-13	11-14
		Adjacent Zone (AZ) Δ10°	4-5	5-6	7-8	8-10	9-12	11-13	12-15
36" x 36"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.003	0.008	0.014	0.022	0.032	0.043	0.056
		NC (Noise Criteria)	-	-	-	-	-	10	14
		Adjacent Zone (AZ) Δ5°	4-4	5-6	6-8	8-10	9-11	10-13	11-14
		Adjacent Zone (AZ) Δ10°	4-5	5-6	7-8	8-10	9-12	11-13	12-15
36" x 48"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.040	0.052
		NC (Noise Criteria)	-	-	-	-	-	-	11
		Adjacent Zone (AZ) Δ5°	4-4	5-6	6-8	8-10	9-11	10-13	11-14
		Adjacent Zone (AZ) Δ10°	4-5	5-6	7-8	8-10	9-12	11-13	12-15
36" x 60"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.003	0.007	0.013	0.021	0.030	0.041	0.053
		NC (Noise Criteria)	-	-	-	-	-	10	14
		Adjacent Zone (AZ) Δ5°	5-6	7-8	9-11	11-13	12-15	14-17	16-19
		Adjacent Zone (AZ) Δ10°	5-6	7-9	9-11	11-14	13-16	15-18	16-20
36" x 72"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.039	0.051
		NC (Noise Criteria)	-	-	-	-	-	-	13
		Adjacent Zone (AZ) Δ5°	5-6	7-8	9-11	11-13	12-15	14-17	16-19
		Adjacent Zone (AZ) Δ10°	5-6	7-9	9-11	11-14	13-16	15-18	16-20

PERFORMANCE NOTES

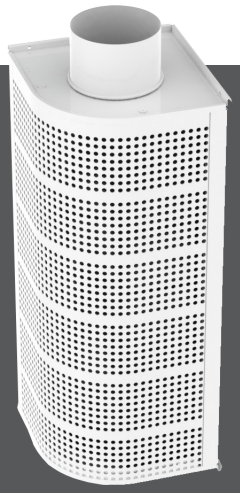
- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DVC1

DVVC

- Curved face displacement diffuser with 90° air discharge pattern for corner mount applications
- Designed to supply a large volume of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Mounting base and telescopic duct cover available as accessories



DVVC

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

DVVC

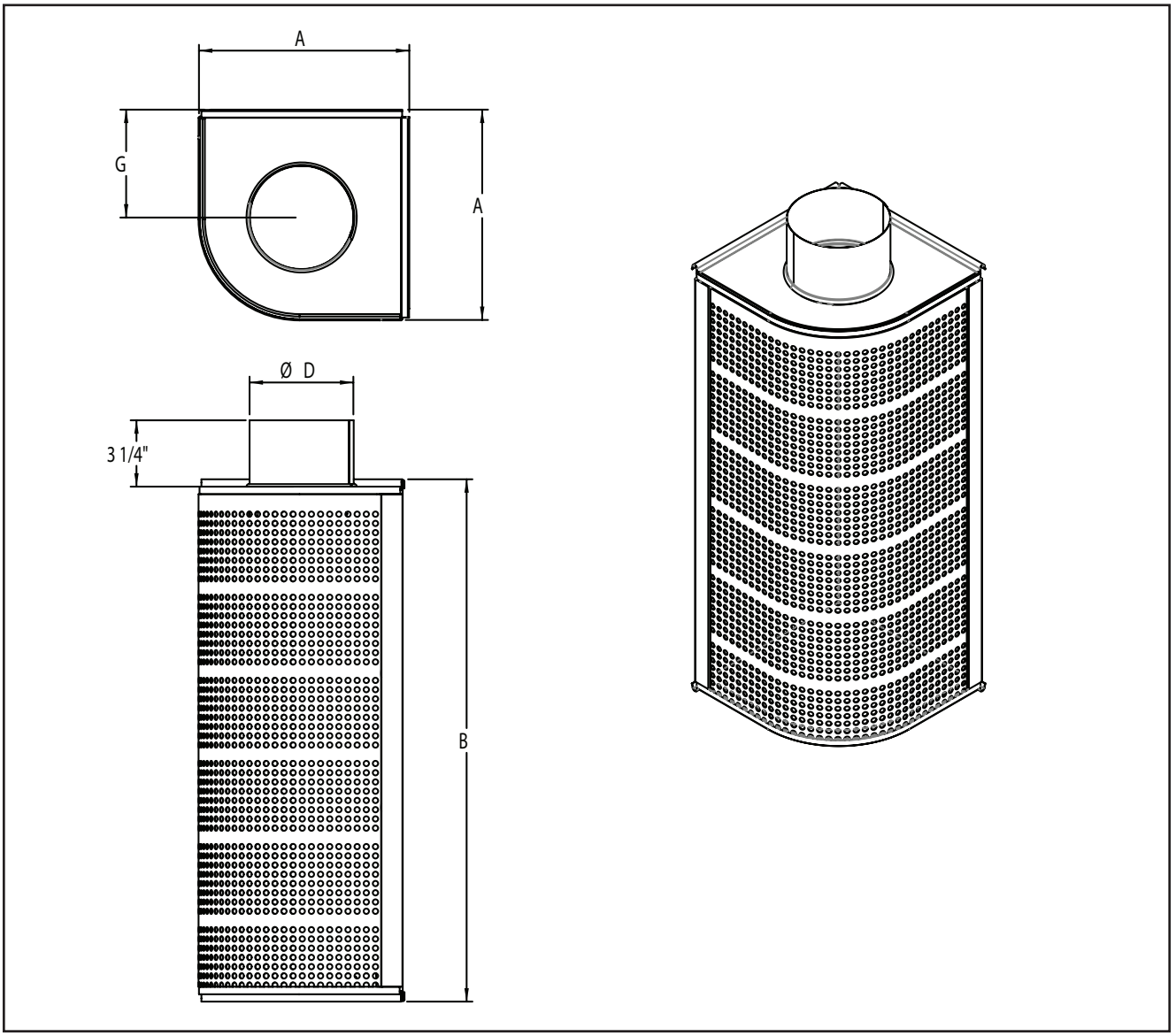
FINISHES

Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

OVERVIEW

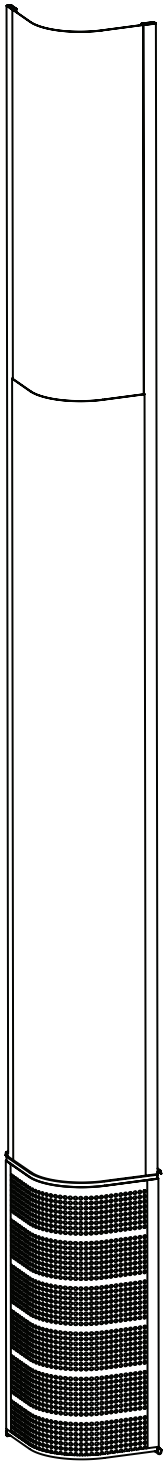
The DVVC is a corner mount displacement diffuser that is designed for corner mounted applications. The units have a two-way air distribution pattern and easily adapts to different floor layouts. They supply a large volume of air at low velocity to the occupied zone by using newly enhanced pattern controllers. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.

DVVC UNIT DIMENSIONS



Model	Inlet Size	Nominal Unit Size	Dimensions (inches)			
			A	B	D	G
DVVC	5	10 x 25	9 5/8	24 1/2	4 7/8	4 7/8
	6	11 x 25	11	24 1/2	5 7/8	5 1/2
	8	13 x 37	12 5/8	36 5/16	7 7/8	6 5/16
	10	15 x 37	14 5/8	36 5/16	9 7/8	7 5/16
	12	18 x 60	17 1/8	60	11 7/8	8 5/8
	16	21 x 79	20 1/2	78 7/8	15 7/8	10 1/4
	10	24 x 24	24	24	19 7/8	12
	12	24 x 36	24	36	19 7/8	12
	14	24 x 48	24	48	19 7/8	12
	14	30 x 24	30	24	23 7/8	15
	16	30 x 36	30	36	23 7/8	15
	16	30 x 48	30	48	23 7/8	15

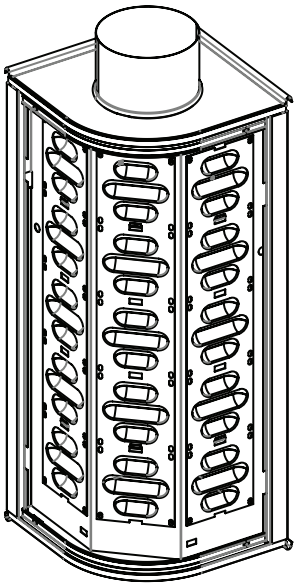
All dimensions are in inches



☐ Optional telescopic duct cover

Unit Size	Diffuser height with duct cover kit*	
	Min	Max
10 x 25	92 1/8	124
11 x 25	92 1/8	
13 x 37	84 3/8	
15 x 37	84 3/8	
18 x 60	92 1/8	
21 x 79	109 7/8	
24 x 24	92 1/8	
24 x 36	84	
24 x 48	92 1/8	
30 x 24	72	
30 x 36	84	
30 x 48	92 1/8	

*Height dimensions do not include mounting base



View with face removed showing integral variable air pattern controllers

☐ Optional mounting base
Height (J): 2-3/4" or 4"

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

All dimensions are in inches

DVVC

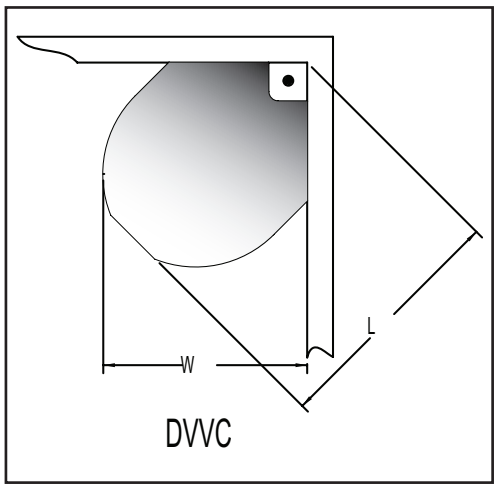
Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
11" x 25"	6" Dia.	Airflow, cfm	38	56	75	94	113	132	151
		Total Pressure	0.004	0.008	0.015	0.023	0.033	0.045	0.059
		NC (Noise Criteria)	-	-	-	-	-	-	10
		Adjacent Zone (AZ) Δ5°	2-3	3-4	4-5	5-6	6-7	7-8	7-9
		Adjacent Zone (AZ) Δ10°	2-3	3-4	4-5	5-7	6-8	7-9	8-10
15" x 37"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.009	0.016	0.025	0.035	0.048	0.063
		NC (Noise Criteria)	-	-	-	-	-	12	17
		Adjacent Zone (AZ) Δ5°	5-6	7-8	8-10	10-12	12-14	13-16	15-18
		Adjacent Zone (AZ) Δ10°	5-6	7-8	9-11	10-13	12-15	14-17	15-19
18" x 60"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.004	0.008	0.014	0.022	0.032	0.043	0.056
		NC (Noise Criteria)	-	-	-	-	-	12	16
		Adjacent Zone (AZ) Δ5°	6-7	8-10	10-13	12-15	14-18	16-20	18-22
		Adjacent Zone (AZ) Δ10°	6-7	8-10	11-13	13-16	15-18	17-21	19-23
21" x 79"	16" Dia.	Airflow, cfm	275	412	550	687	825	962	1100
		Total Pressure	0.004	0.008	0.015	0.024	0.034	0.046	0.060
		NC (Noise Criteria)	-	-	-	-	11	17	21
		Adjacent Zone (AZ) Δ5°	8-10	12-14	15-18	18-22	20-26	23-29	26-33
		Adjacent Zone (AZ) Δ10°	9-10	12-15	15-19	18-23	21-27	24-30	27-34
24" x 24"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.009	0.016	0.025	0.037	0.050	0.065
		NC (Noise Criteria)	-	-	-	-	-	13	18
		Adjacent Zone (AZ) Δ5°	3-4	5-6	6-7	7-9	8-10	10-12	11-13
		Adjacent Zone (AZ) Δ10°	4-4	5-6	6-8	8-9	9-11	10-12	11-14
24" x 36"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.004	0.009	0.015	0.024	0.035	0.047	0.062
		NC (Noise Criteria)	-	-	-	-	-	14	19
		Adjacent Zone (AZ) Δ5°	5-6	6-8	8-10	10-12	11-14	13-16	15-18
		Adjacent Zone (AZ) Δ10°	5-6	7-8	9-10	10-13	12-15	14-17	15-19
24" x 48"	14" Dia.	Airflow, cfm	210	315	420	525	630	735	840
		Total Pressure	0.004	0.009	0.015	0.024	0.035	0.047	0.062
		NC (Noise Criteria)	-	-	-	-	10	16	20
		Adjacent Zone (AZ) Δ5°	6-7	8-10	11-13	13-16	15-18	17-21	19-23
		Adjacent Zone (AZ) Δ10°	6-8	9-11	11-13	13-16	15-19	18-22	20-24
30" x 24"	14" Dia.	Airflow, cfm	210	315	420	525	630	735	840
		Total Pressure	0.005	0.012	0.021	0.034	0.048	0.066	0.086
		NC (Noise Criteria)	-	-	-	-	15	20	25
		Adjacent Zone (AZ) Δ5°	5-6	7-9	9-11	11-13	13-16	15-18	16-20
		Adjacent Zone (AZ) Δ10°	5-6	8-9	10-12	12-14	13-16	15-19	17-21

DVVC (continued)

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
30" x 36"	16" Dia.	Airflow, cfm	275	412	550	687	825	962	1100
		Total Pressure	0.005	0.010	0.018	0.029	0.041	0.056	0.073
		NC (Noise Criteria)	-	-	-	-	14	20	24
		Adjacent Zone (AZ) Δ5°	6-8	9-11	12-14	14-17	16-20	18-23	20-25
		Adjacent Zone (AZ) Δ10°	7-8	9-11	12-15	14-18	17-21	19-23	21-26
30" x 48"	16" Dia.	Airflow, cfm	275	412	550	687	825	962	1100
		Total Pressure	0.004	0.009	0.015	0.024	0.034	0.047	0.061
		NC (Noise Criteria)	-	-	-	-	11	17	21
		Adjacent Zone (AZ) Δ5°	6-8	9-11	12-14	14-17	16-20	18-23	20-25
		Adjacent Zone (AZ) Δ10°	7-8	9-11	12-15	14-18	17-21	19-23	21-26

PERFORMANCE NOTES

- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water

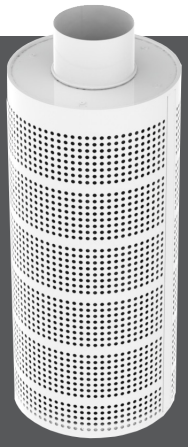


Titus
Redefine your comfort zone.™

Circular Displacement Diffuser

DVCP

- Circular displacement diffuser with 360° air discharge pattern for floor installation
- Designed to supply a large volume of air at low velocity to the occupied zone
- Includes integral variable air pattern controllers for easy adjustment of the airflow spread pattern
- Includes air volume measurement outlet to facilitate balancing. K-factor is marked on outlet.
- Material is galvanized steel and aluminum
- Standard finish is #26 white (powdercoat)
- Mounting base and telescopic duct cover available as accessories



DVCP

woodgrains energy solutions

See website for Specifications

AVAILABLE MODEL:

DVCP

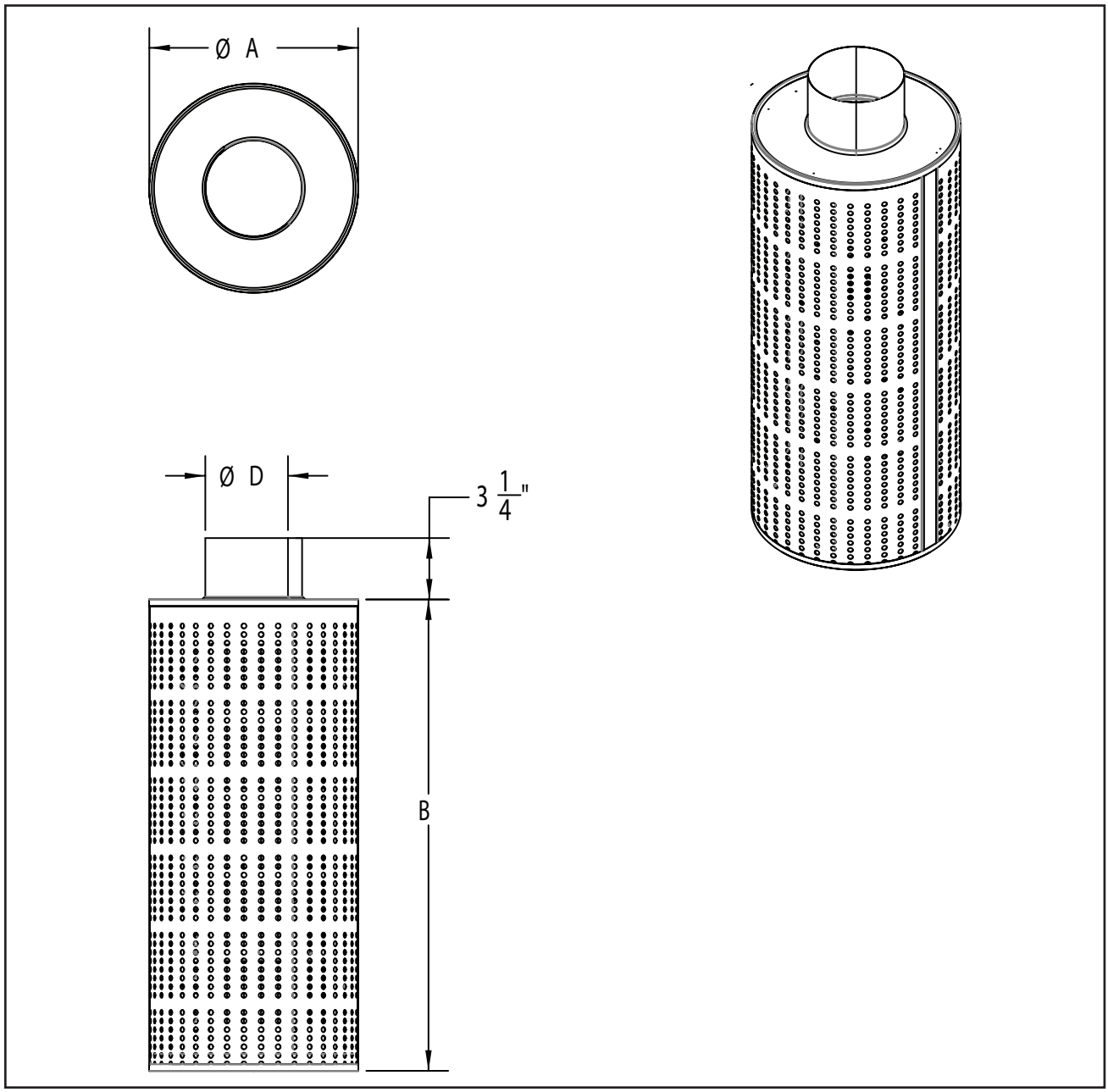
FINISHES

Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

OVERVIEW

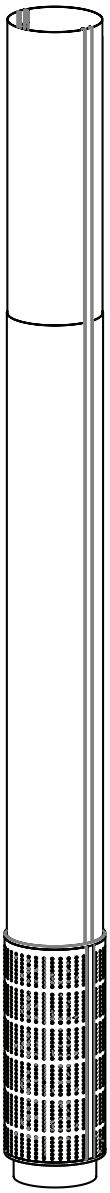
The DVCP is a round freestanding circular displacement diffuser designed for floor mounted applications. It provides a 360° air distribution discharge pattern. The DVCP is designed to supply a large volume of air at low velocity into the occupied space and works well in lobbies, airports and restaurants. This model can contribute toward achieving LEED EA Credit 1: Optimize Energy Performance; IEQc2: Increased Ventilation; and IEQc7.1: Thermal Comfort - Design.

DVCP UNIT DIMENSIONS



Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)		
			A	B	D
DVCP	5	11 x 24	10 7/16	24	4 7/8
	6	12 x 24	11 13/16	24	5 7/8
	8	14 x 36	13 3/8	35 3/4	7 7/8
	10	16 x 36	15 3/8	35 3/4	9 7/8
	12	18 x 59	17 15/16	59 3/8	11 7/8
	16	22 x 79	21 1/4	78 1/4	15 7/8
	20	26 x 79	25 1/4	78 1/4	19 7/8
	24	31 x 79	30 5/16	78 1/4	23 7/8

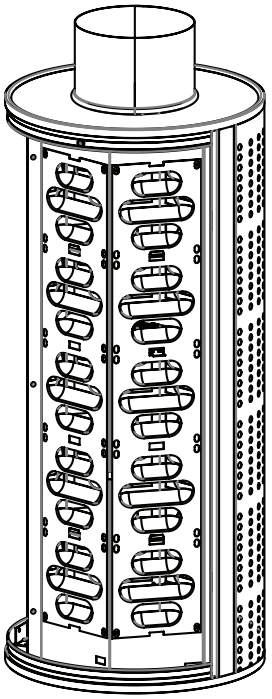
All dimensions are in inches



☐ Optional telescopic duct cover

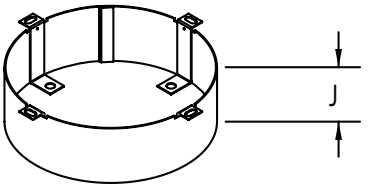
Unit Size	Diffuser height with duct cover kit*	
	Min	Max
11 x 24	91 9/16	123 7/16
12 x 24	91 9/16	
14 x 36	83 12/16	
16 x 36	83 12/16	
18 x 59	90 12/16	
22 x 79	109 1/4	
26 x 79		
31 x 79		

*Height dimensions do not include mounting base



View with face removed showing integral variable air pattern controllers

☐ Optional mounting base
Height (J): 2-3/4" or 4"



For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

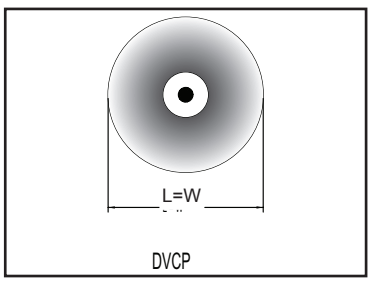
All dimensions are in inches

DVCP

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
12" x 24"	6" Dia.	Airflow, cfm	38	56	75	94	113	132	151
		Total Pressure	0.003	0.007	0.013	0.020	0.028	0.039	0.051
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	2-2	3-3	3-3	4-4	4-4	4-4	5-5
		Adjacent Zone (AZ) Δ10°	2-2	3-3	3-3	4-4	5-5	5-5	5-5
14" x 36"	8" Dia.	Airflow, cfm	68	101	135	169	203	237	271
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.040	0.052
		NC (Noise Criteria)	-	-	-	-	-	-	-
		Adjacent Zone (AZ) Δ5°	3-3	4-4	4-4	5-5	6-6	6-6	7-7
		Adjacent Zone (AZ) Δ10°	3-3	4-4	5-5	6-6	6-6	7-7	8-8
16" x 36"	10" Dia.	Airflow, cfm	106	160	213	266	319	372	425
		Total Pressure	0.004	0.008	0.014	0.022	0.032	0.043	0.056
		NC (Noise Criteria)	-	-	-	-	-	-	13
		Adjacent Zone (AZ) Δ5°	4-4	5-5	6-6	7-7	8-8	8-8	9-9
		Adjacent Zone (AZ) Δ10°	4-4	6-6	7-7	8-8	9-9	9-9	10-10
18" x 59"	12" Dia.	Airflow, cfm	154	231	308	385	461	538	615
		Total Pressure	0.003	0.007	0.013	0.020	0.028	0.039	0.051
		NC (Noise Criteria)	-	-	-	-	-	10	15
		Adjacent Zone (AZ) Δ5°	5-5	6-6	7-7	8-8	9-9	10-10	11-11
		Adjacent Zone (AZ) Δ10°	5-5	7-7	8-8	9-9	11-11	12-12	13-13
22" x 79"	16" Dia.	Airflow, cfm	275	412	550	687	825	962	1100
		Total Pressure	0.003	0.007	0.013	0.020	0.029	0.039	0.051
		NC (Noise Criteria)	-	-	-	-	-	14	19
		Adjacent Zone (AZ) Δ5°	7-7	9-9	10-10	12-12	13-13	15-15	16-16
		Adjacent Zone (AZ) Δ10°	8-8	10-10	12-12	14-14	15-15	17-17	18-18
26" x 79"	20" Dia.	Airflow, cfm	431	646	862	1077	1293	1508	1724
		Total Pressure	0.003	0.008	0.014	0.022	0.031	0.042	0.055
		NC (Noise Criteria)	-	-	-	-	13	18	23
		Adjacent Zone (AZ) Δ5°	9-9	11-11	14-14	16-16	18-18	19-19	21-21
		Adjacent Zone (AZ) Δ10°	10-10	13-13	15-15	18-18	20-20	22-22	24-24
31" x 79"	24" Dia.	Airflow, cfm	622	933	1244	1554	1865	2176	2487
		Total Pressure	0.004	0.008	0.015	0.023	0.033	0.045	0.058
		NC (Noise Criteria)	-	-	-	-	16	21	26
		Adjacent Zone (AZ) Δ5°	11-11	14-14	17-17	19-19	22-22	24-24	26-26
		Adjacent Zone (AZ) Δ10°	12-12	16-16	19-19	22-22	25-25	27-27	30-30

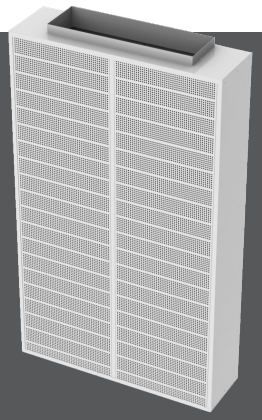
PERFORMANCE NOTES

- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DVRI-HC (Plexicon)

- The Titus DVRI-HC "Plexicon" is a combination displacement/ mixed air diffuser that can be positioned against a wall in flush or surface mount applications to provide cooling and perimeter heating in the space
- The dual plenum design features a front plenum ducted to a displacement diffuser at the top and rear plenum ducted to a CT diffuser at the bottom of the unit
- The DVRI-HC uses displacement principles to cool and mixed airflow principles to heat from a single unit assembly with one inlet connection
- A single blade damper rotates to shut off the front (cooling) or rear (heating) plenum. The damper is driven by a 24 volt motor/ actuator that provides the auto-changeover action for the cooling/ heating applications (transformer by others).
- Available in two sizes: 36" x 79" with 14" diameter inlet, 47" x 79" with 24" x 8" inlet
- Optional duct cover and mounting base available as accessories
- Material is galvanized steel and aluminum



DVRI-HC (PLEXICON)

woodgrains dual-function energy solutions

See website for Specifications

AVAILABLE MODELS:

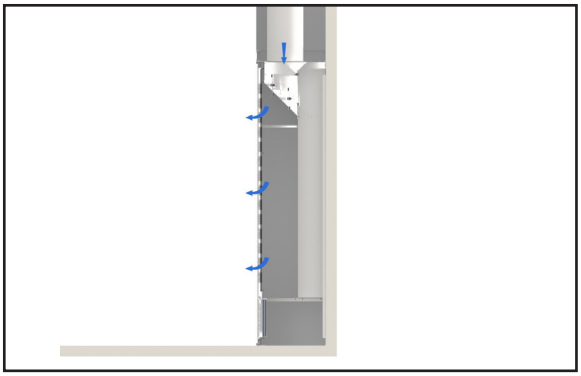
DVRI-HC 14
DVRI-HC 32

FINISHES

Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

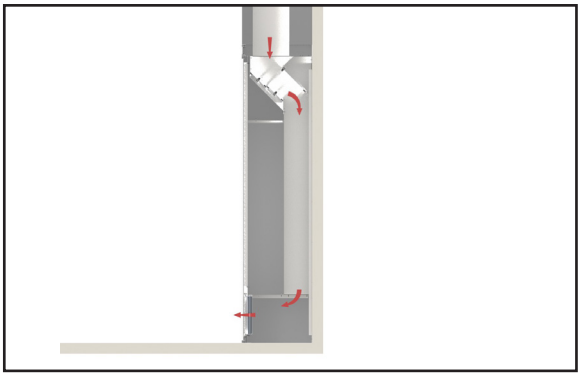
OVERVIEW

The DVRI-HC "Plexicon" is a dual function diffuser that combines displacement ventilation and mixed air from one unit. It provides displacement cooling from the top section and traditional heating from the bottom section. The unique dual plenum design utilizes a single supply duct connection for ease of design and installation.



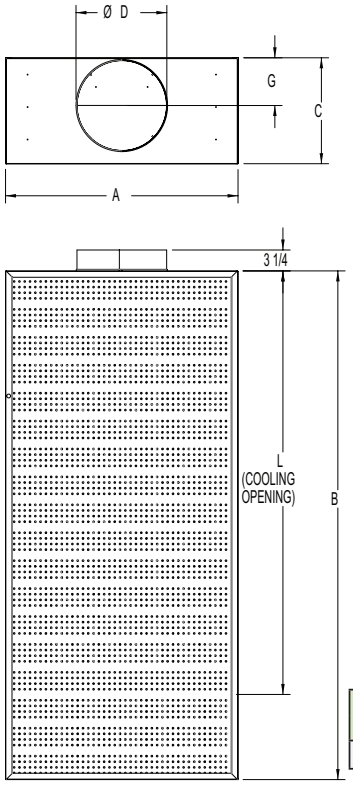
Above: Plexicon cooling mode

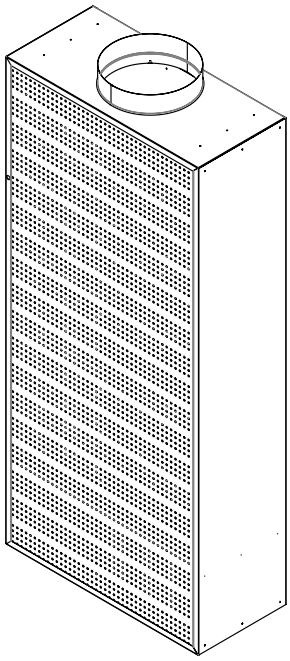
Below: Plexicon heating mode



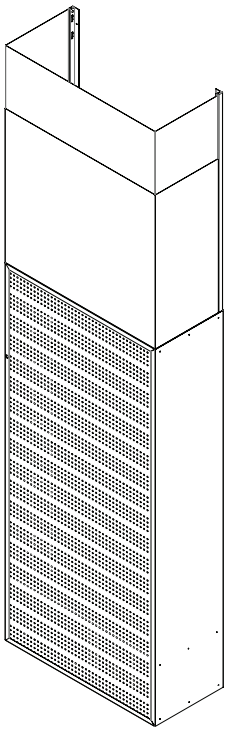
The Titus AR mobile app is available for download on most Android devices and iOS

DVRI-HC 14





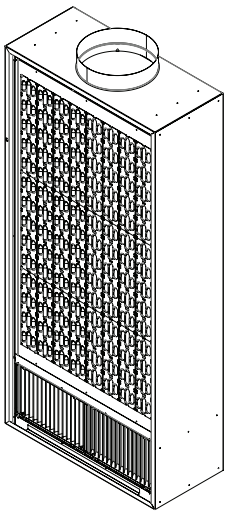
Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)					
			A	B	C	D	G	L
DVRI-HC	14	36 x 79	36	78 3/8	16 5/16	13 7/8	7 5/8	65 1/4



☐ Optional telescopic duct cover

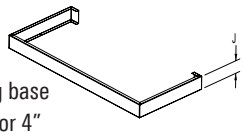
Model	Unit Size	Diffuser height with duct cover kit*	
		Min	Max
DVRI-HC	36 x 79	109 7/8	124

*Height dimensions do not include mounting base



View with face removed showing integral variable air pattern controllers

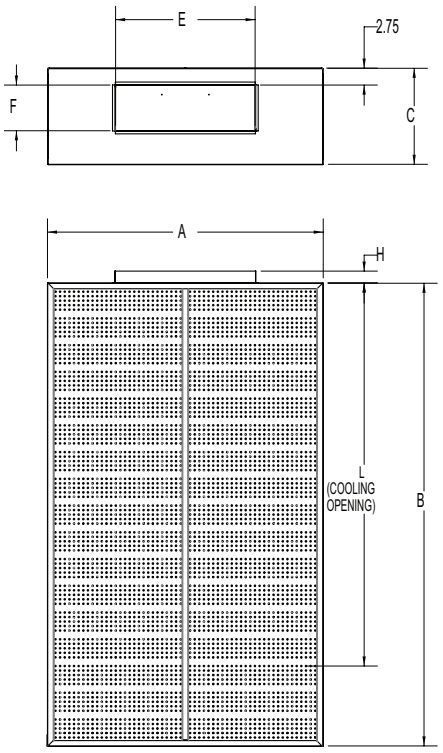
For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

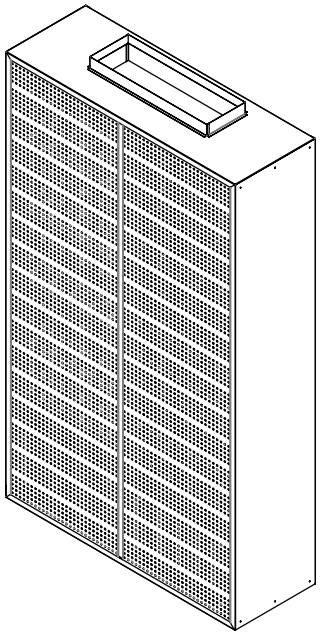


☐ Optional mounting base
Height (J): 2-3/4" or 4"

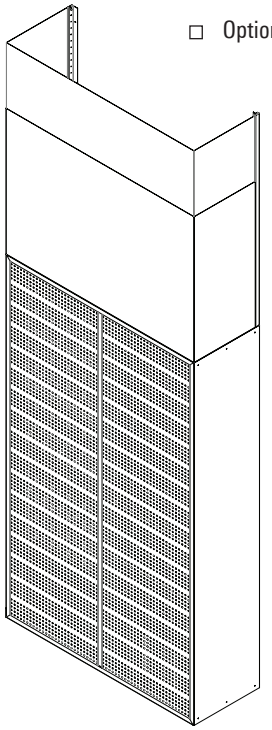
All dimensions are in inches

DVRI-HC 32





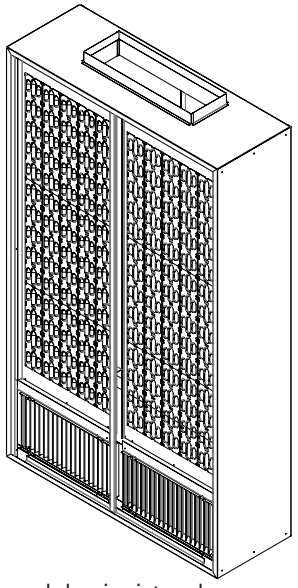
Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)						
			A	B	C	E	F	H	L
DVRI-HC	24 x 8	47 x 79	46 7/8	78 3/8	16 5/16	23 7/8	7 7/8	2	65 1/4



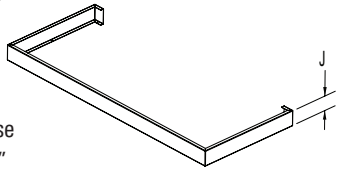
☐ Optional telescopic duct cover

Model	Unit Size	Diffuser height with duct cover kit*	
		Min	Max
DVRI-HC	47 x 79	109 7/8	124

*Height dimensions do not include mounting base



View with face removed showing integral variable air pattern controllers



☐ Optional mounting base
Height (J): 2-3/4" or 4"

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82

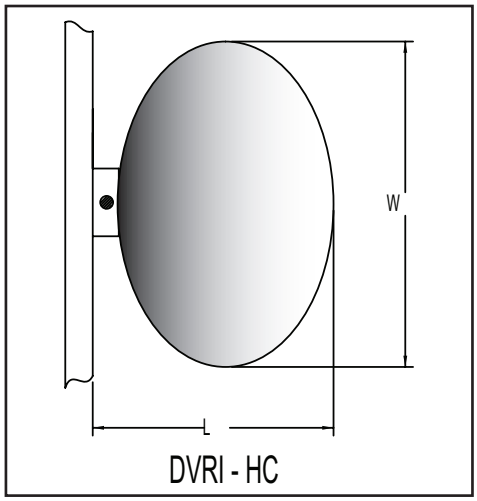
All dimensions are in inches

DVRI-HC COOLING DATA

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
36" x 79"	14" Dia.	Airflow, cfm	210	315	420	525	630	735	840
		Total Pressure	0.005	0.011	0.020	0.032	0.046	0.062	0.081
		NC (Noise Criteria)	-	-	-	10	16	21	25
		Adjacent Zone (AZ) ΔT5°	6-5	7-8	9-11	10-14	12-17	13-20	14-23
		Adjacent Zone (AZ) ΔT10°	8-6	11-10	13-13	15-17	17-20	18-24	20-27
47" x 79"	24" x 8"	Airflow, cfm	261	392	522	653	783	914	1045
		Total Pressure	0.006	0.013	0.024	0.036	0.053	0.071	0.092
		NC (Noise Criteria)	-	-	11	18	24	29	33
		Adjacent Zone (AZ) ΔT5°	7-5	9-8	11-11	13-14	14-17	16-20	17-23
		Adjacent Zone (AZ) ΔT10°	10-6	13-10	15-13	18-17	20-20	22-24	24-27

PERFORMANCE NOTES

- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DVRI-HC HEATING DATA

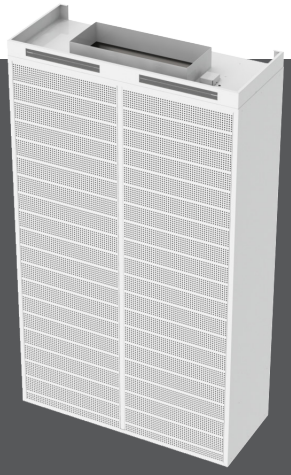
Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
36" x 79"	14" Dia.	Airflow, cfm	210	315	420	525	630	735	840
		Total Pressure	0.011	0.024	0.042	0.066	0.095	0.130	0.169
		NC (Noise Criteria)	-	-	11	18	24	28	33
		Throw (150-100-50 fpm) at ΔT15°F	3-4-8	4-6-12	6-8-16	7-10-17	8-12-19	10-15-21	11-16-22
47" x 79"	24" x 8"	Airflow, cfm	261	392	522	653	783	914	1045
		Total Pressure	0.010	0.023	0.041	0.065	0.093	0.127	0.166
		NC (Noise Criteria)	-	-	14	21	27	32	36
		Throw (150-100-50 fpm) at ΔT15°F	3-5-9	5-7-14	6-9-17	8-12-19	9-14-21	11-16-23	12-17-25

PERFORMANCE NOTES

- Data obtained from tests conducted in accordance with ANSI/ ASHRAE Standard 70-2006
- Throw values are given for terminal velocities of 150, 100, and 50 fpm at a ΔT of 15° F. The ΔT is the difference in the supply air and room air temperature
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) is space denotes an NC value of less than 10
- All pressures are given in inches of water

DVRI-HCS (Solar Plexicon)

- The Titus DVRI-HCS Plexicon is a combination displacement/mixed air diffuser that can be positioned against a wall in flush or surface mount applications to provide cooling and perimeter heating in the space
- The dual plenum design features a front plenum ducted to a displacement diffuser at the top and rear plenum ducted to a CT diffuser at the bottom of the unit
- The DVRI-HCS uses displacement principles to cool and mixed airflow principles to heat from a single unit assembly with one inlet connection
- No external power needed for operation, unit features energy harvesting technology from solar and ambient room light to power actuactors
- Available in two sizes: 36" x 79" with 14" diameter inlet, 47" x 79" with 24" x 8" inlet
- Optional duct cover and mounting base available as accessories
- Material is galvanized steel and aluminum



DVRI-HCS (SOLAR PLEXICON)

smart logic | dual-function | light powered | woodgrains | energy solutions

See website for Specifications

AVAILABLE MODEL:

DVRI-HCS

FINISHES

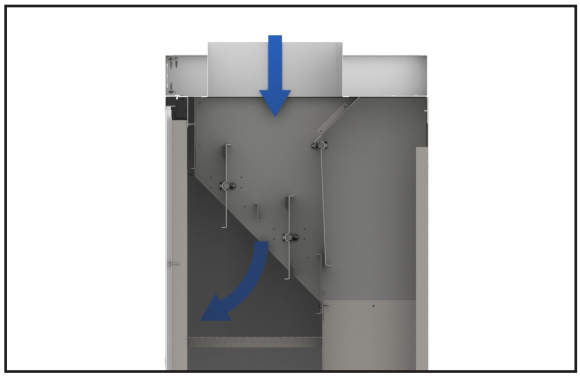
Standard Finish - #26 White
Optional Finish - Woodgrains (See Woodgrains Brochure for Finishes)

OVERVIEW

The DVRI-HCS "Solar Plexicon" is a solar-powered, energy-harvesting dual function diffuser that combines displacement ventilation and mixed air from one unit. It provides displacement cooling from the top section and traditional heating from the bottom section of the diffuser.

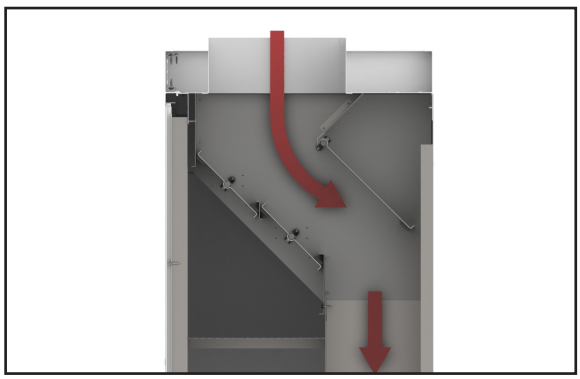
ADVANTAGES

- Both internal plenums are connected to motor/actuactor assemblies that provides the auto-changeover action for cooling & heating
- Solar cell mounted on face collects light energy and stores on internal capacitor
- Smart logic programming on internal P.C. board checks supply air temperature in 10 minute intervals
- Cooling section features easily adjustable air pattern controllers for spread pattern adjustment

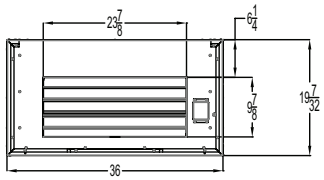


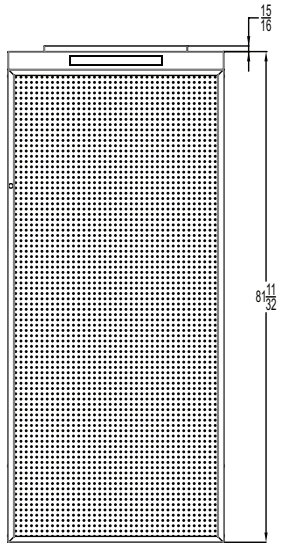
Above: Solar Plexicon cooling mode

Below: Solar Plexicon heating mode

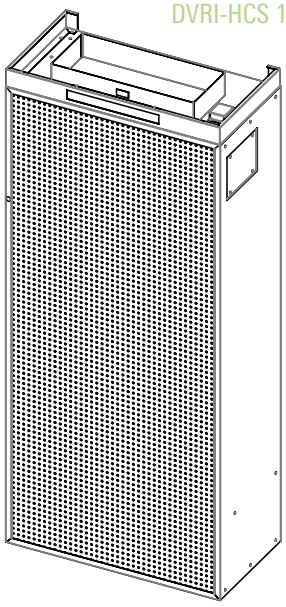


The Titus AR mobile app is available for download on most Android devices and iOS

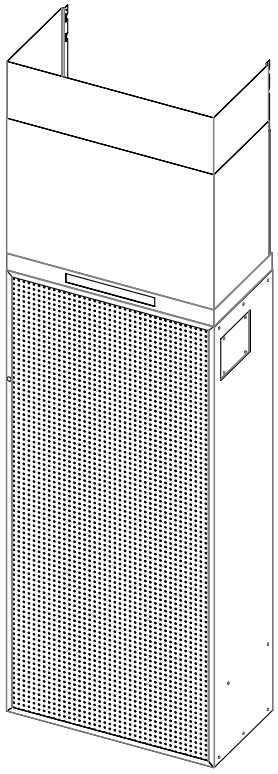




DVRI-HCS 14" INLET



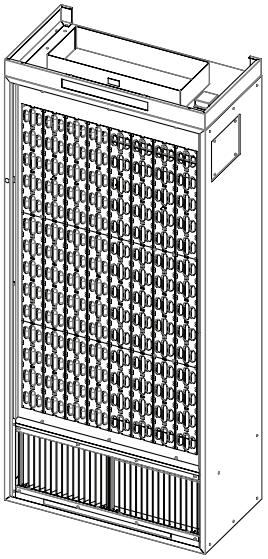
Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)					
			A	B	C	D	G	L
DVRI-HCS	14	36 x 79	36	78 3/8	16 5/16	13 7/8	7 7/8	65 1/4



☐ Optional telescopic duct cover

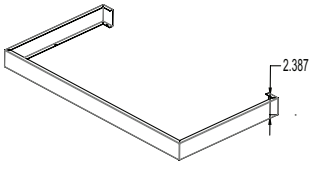
Model	Unit Size	Diffuser height with duct cover kit*	
		Min	Max
DVRI-HCS	36 x 79	109 7/8	124

*Height dimensions do not include mounting base



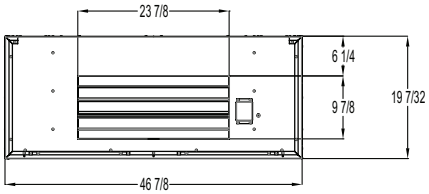
View with face removed showing integral variable air pattern controllers

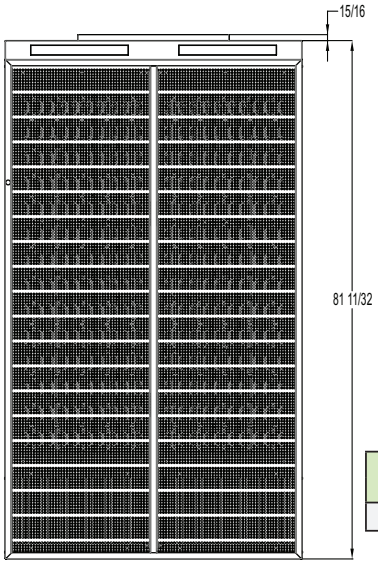
For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82



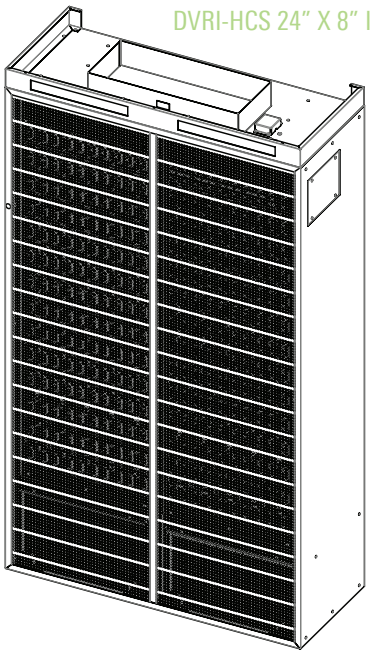
☐ Optional mounting base
Height (J): 2-3/4" or 4"

All dimensions are in inches



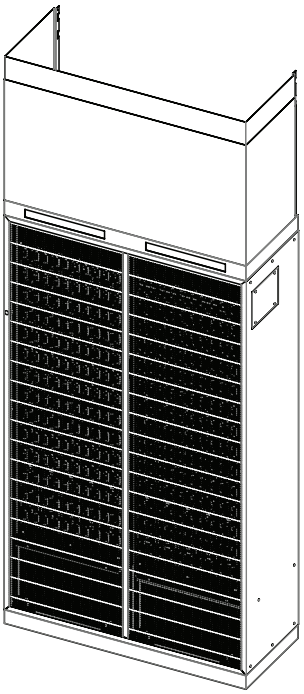


DVRI-HCS 24" X 8" INLET



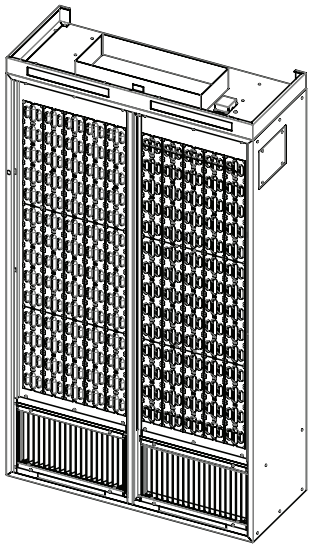
Model	Inlet Size	Nominal Unit Size	Unit Dimensions (inches)						
			A	B	C	E	F	H	L
DVRI-HCS	24 x 8	47 x 79	46 3/8	78 3/8	16 5/16	13 7/8	7 7/8	2	65 1/4

☐ Optional telescopic duct cover



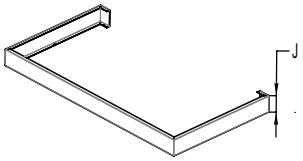
Model	Unit Size	Diffuser height with duct cover kit*	
		Min	Max
DVRI-HCS	47 x 79	109 7/8	124

*Height dimensions do not include mounting base



View with face removed showing integral variable air pattern controllers

For detailed instructions on how to change the adjacent zone using the variable air pattern controllers, refer to page T82



☐ Optional mounting base
Height (J): 2-3/4" or 4"

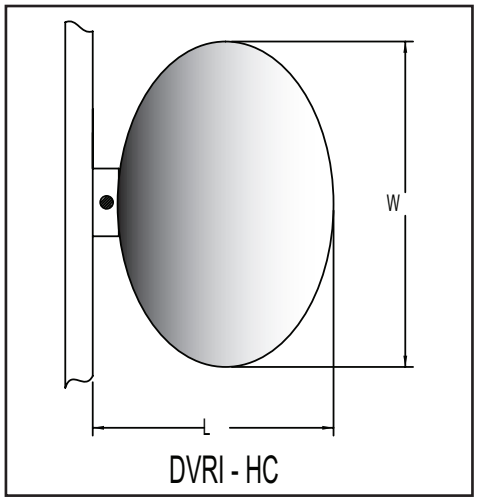
All dimensions are in inches

DVRI-HCS COOLING DATA

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
36" x 79"	14" Dia.	Airflow, cfm	210	315	420	525	630	735	840
		Total Pressure	0.005	0.011	0.020	0.032	0.046	0.062	0.081
		NC (Noise Criteria)	-	-	-	10	16	21	25
		Adjacent Zone (AZ) ΔT5°	6-5	7-8	9-11	10-14	12-17	13-20	14-23
		Adjacent Zone (AZ) ΔT10°	8-6	11-10	13-13	15-17	17-20	18-24	20-27
47" x 79"	24" x 8"	Airflow, cfm	261	392	522	653	783	914	1045
		Total Pressure	0.006	0.013	0.024	0.036	0.053	0.071	0.092
		NC (Noise Criteria)	-	-	11	18	24	29	33
		Adjacent Zone (AZ) ΔT5°	7-5	9-8	11-11	13-14	14-17	16-20	17-23
		Adjacent Zone (AZ) ΔT10°	10-6	13-10	15-13	18-17	20-20	22-24	24-27

PERFORMANCE NOTES

- The adjacent zone (AZ) is the discharge isovel at 1" above the floor where the terminal velocity is 50 fpm
- Adjacent zone dimensions were obtained from tests conducted in accordance with Nordtest method of aerodynamic testing and rating of low velocity
- Sound and pressure data were obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006
- ΔT is the "under temperature" which is the difference between room air temperature at 3-½ ft above the floor and the supply air temperature
- Throw values shown are distances in feet for temperature differentials of 5°F ΔT and 10°F ΔT cooling at 50 fpm terminal velocity. The first listed throw value corresponds to the length and the second throw value to the width (see diagram at bottom of page).
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) in space denotes an NC value of less than 10
- All pressures are given in inches of water



DVRI - HC

DVRI-HCS HEATING DATA

Unit Size (W x H)	Inlet Size	Neck Velocity	200	300	400	500	600	700	800
		Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040
36" x 79"	14" Dia.	Airflow, cfm	210	315	420	525	630	735	840
		Total Pressure	0.011	0.024	0.042	0.066	0.095	0.130	0.169
		NC (Noise Criteria)	-	-	11	18	24	28	33
		Throw (150-100-50 fpm) at ΔT15°F	3-4-8	4-6-12	6-8-16	7-10-17	8-12-19	10-15-21	11-16-22
47" x 79"	24" x 8"	Airflow, cfm	261	392	522	653	783	914	1045
		Total Pressure	0.010	0.023	0.041	0.065	0.093	0.127	0.166
		NC (Noise Criteria)	-	-	14	21	27	32	36
		Throw (150-100-50 fpm) at ΔT15°F	3-5-9	5-7-14	6-9-17	8-12-19	9-14-21	11-16-23	12-17-25

PERFORMANCE NOTES

- Data obtained from tests conducted in accordance with ANSI/ ASHRAE Standard 70-2006
- Throw values are given for terminal velocities of 150, 100, and 50 fpm at a ΔT of 15° F. The ΔT is the difference in the supply air and room air temperature
- NC values based on octave band 2 to 7 sound power levels minus a room absorption of 10 dB
- Each NC value represents the noise criteria curve which will not be exceeded by the sound pressure in any of the octave bands, 2 through 7, with a room absorption of 10 dB, re 10^{-12} watts
- Dash (-) is space denotes an NC value of less than 10
- All pressures are given in inches of water

Displacement Diffuser Adjustment

All Titus Displacement diffusers feature integral variable air pattern controllers located in the unit behind the perforated face (see illustration 1). These pattern controllers can be removed and repositioned to change the adjacent zone pattern from the diffuser face. To adjust the pattern: (see illustration 2).

- Remove diffuser face
- Remove louvers
- Reposition louvers
- Replace face

This unique feature provides a high level of flexibility for the end user. They can react to changes in the space by adjusting the adjacent zone rather than disconnecting and moving the diffuser. Illustration 3 shows a conference room with displacement diffusers and the standard adjacent zone from the factory. Illustration 4 shows how these adjacent zones can be changed to accomodate the needs in the space.

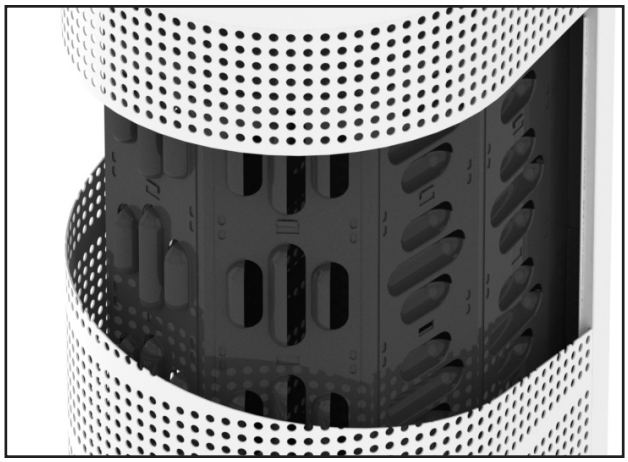


Illustration 1. Cutaway of Displacement Diffuser

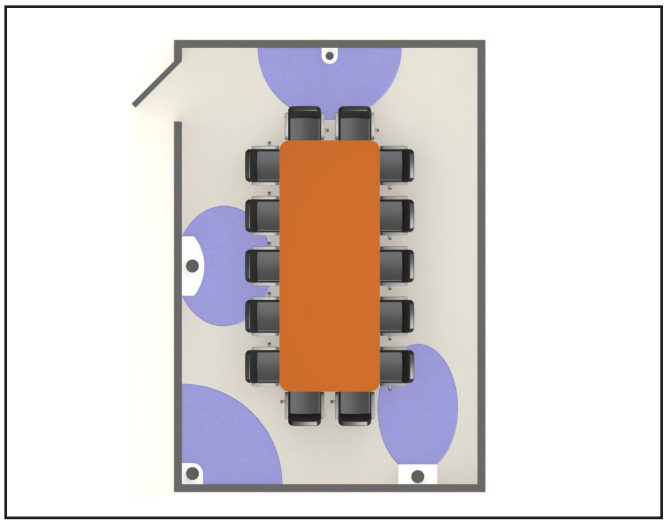


Illustration 3. Standard Air Patterns

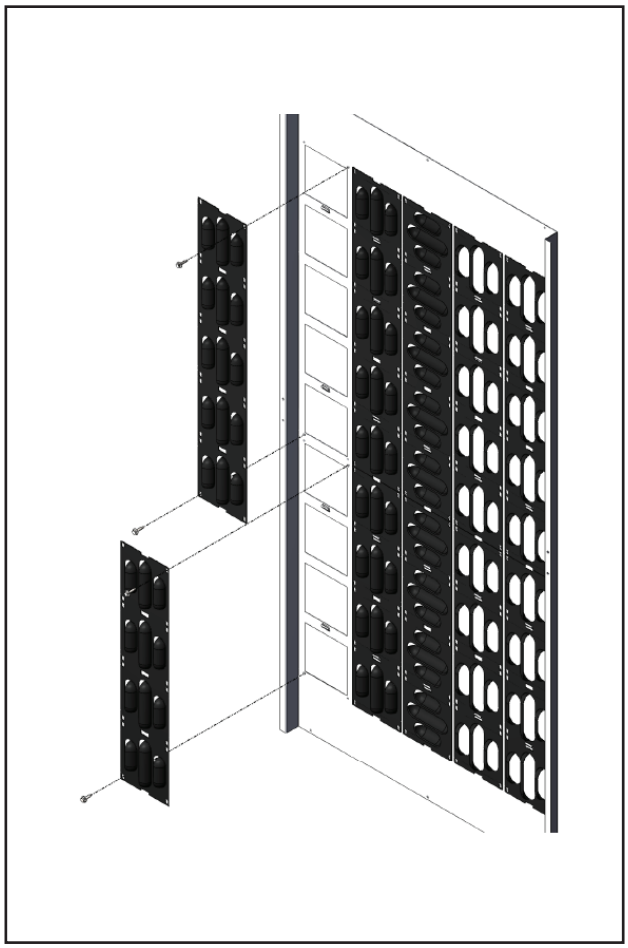


Illustration 2. Adjust the pattern

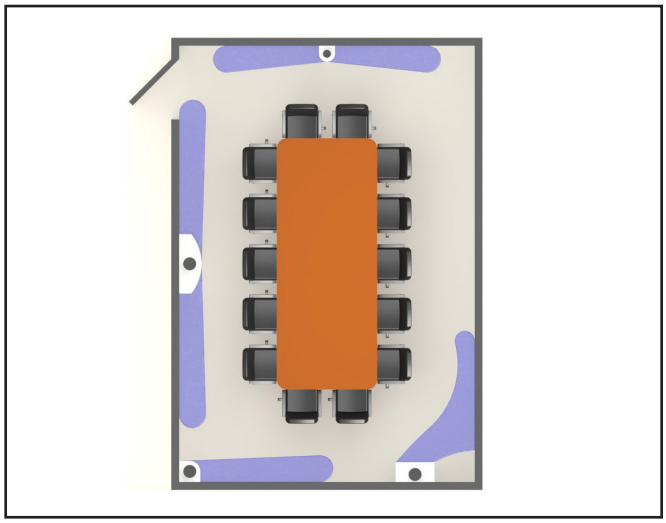


Illustration 4. Adjusted Air Patterns