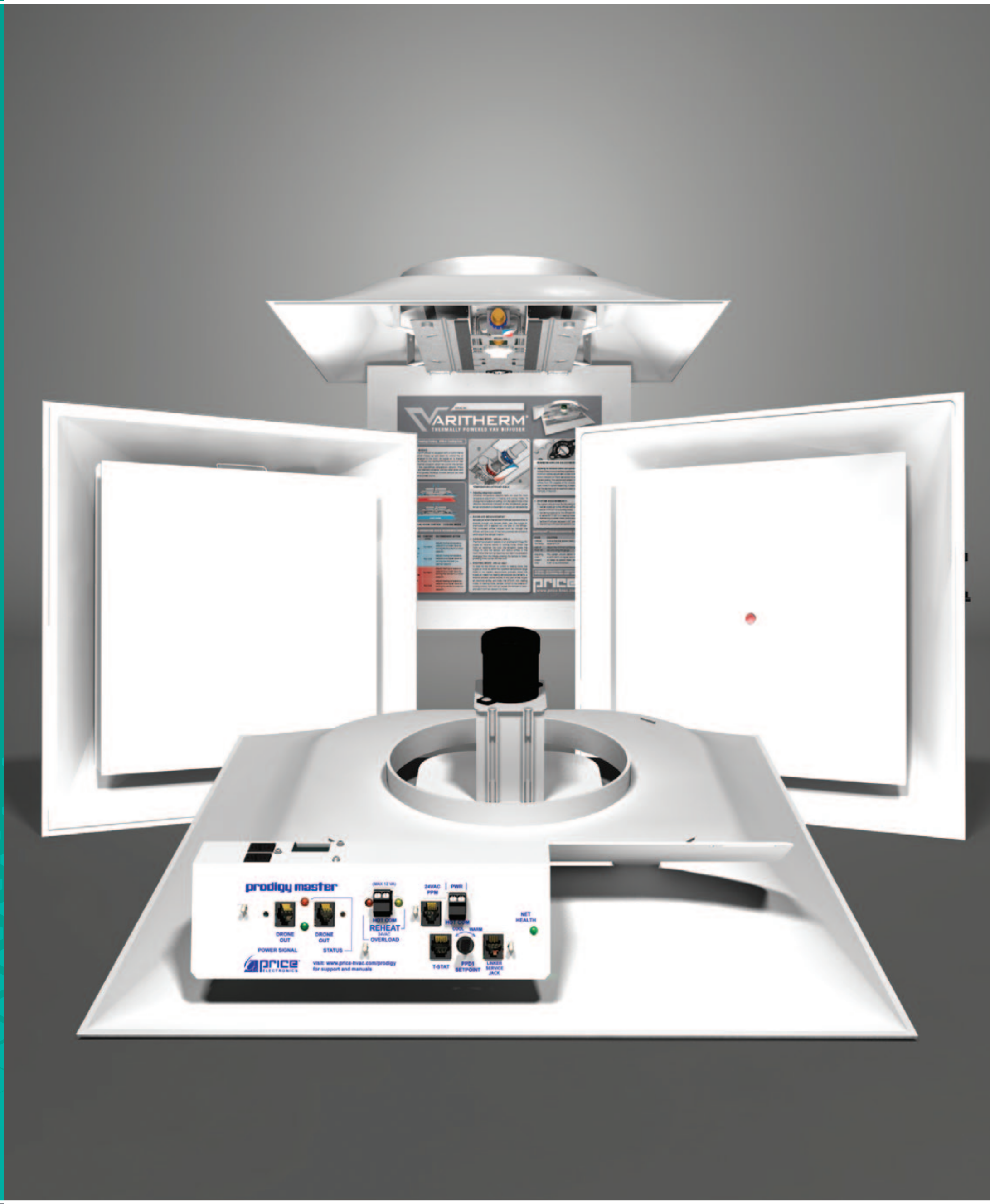


Engineering Guide
VAV Diffusers

Please refer to the **Price Engineer's HVAC Handbook** for more information on VAV Diffusers.

Diffuser Types

Conventional air distribution systems typically group several rooms into a zone that is controlled by a single thermostat. Because rooms within the zone can have different heating/cooling requirements, the system's response to heating/cooling loads within the zone may not be consistent with load requirements. The result can be a system that compromises the comfort of the occupants in each room by providing a blanket response to individual needs. As well, there is resulting system inefficiency due to the overheating/overcooling of rooms within the building.

Self-modulating Variable Air Volume (VAV) diffusers allow for smaller, comfortable zones. They monitor local space conditions and regulate air flow to satisfy the occupants' selected level of comfort. As air flow varies, the unique design of VAV diffusers adjusts an integral damper to maintain face discharge velocities and excellent throw characteristics. VAV diffusers can help solve the inconsistent throws or dumping that may occur with some overhead diffusers due to varying supply conditions.

Several different types of VAV diffusers exist, however most can be grouped into two models: Thermally Powered and Electronically Powered.

Thermally Powered VAV Diffusers

Thermally powered VAV diffusers, shown in **Figure 1**, commonly use thermal actuators to modulate the flow rate of supply air into a room according to a desired temperature setting. The diffuser works independent of a BAS and does not require external power. Based on this, the unit provides system flexibility and a low-cost installation. Each occupant or small group of occupants can adjust their local diffuser to their desired temperature, ensuring tailored comfort levels for all occupants in the building.

A thermally powered VAV diffuser installs much like any other ceiling diffuser. Once the supply duct is connected and air is flowing, the thermally powered VAV diffuser begins to operate. Temperature set-point adjustments and minimum air flow settings can be adjusted on the diffuser core. The diffuser measures the room temperature by inducing room air into the diffuser core and passing it over a thermal actuator. Linkage contained within the core adjusts the damper based on the difference between room and desired set-point temperatures. Typically, diffusers are available for VAV cooling and VAV cooling/heating with automatic changeover.

Electronically Powered VAV Diffusers

An electronically powered VAV diffuser, shown in **Figure 2**, uses an electric modulating damper inside the diffuser core assembly. The electronics to control the device are mounted on the top of the backpan, out of sight from the occupied space. The analog or DDC controller with proportional integral control will provide stable, precise control with fast response. Space temperature control within 1 °F of set-point, true VAV cooling and heating, activation of perimeter heat, and optional BACnet interface are all possible with these types of units.

An electronically powered VAV diffuser will require an electrical connection. Temperature set-point adjustment can be made in a variety of ways: on board the unit, wall mounted thermostat, remote control, or a building management system such as BACnet. The room temperature is measured either by inducing room air into the diffuser core or by the use of a wall thermostat. For a zone larger than one diffuser, a master diffuser can drive several drone diffusers. The drone units will adjust their dampers in unison as dictated by the master unit.

Figure 1: Thermally powered VAV diffuser

Figure 2: Electronically powered VAV diffuser

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimeter.

Conventional Design vs. VAV Diffuser Layouts

Conventional Diffuser System Layout

In **Figure 3**, a zone thermostat controls the conditions for a zone, which can include several rooms. In this illustration, the VAV terminal will supply air to the zone based on the feedback from the thermostat. When the load has been satisfied, the damper limits the downstream air flow. A pressure control valve monitors the upstream static pressure and allows air to bypass the supply duct.

The disadvantage to this design is that the one thermostat is controlling multiple rooms within a zone. The loads within each of the three rooms will vary throughout the day and will require different supply conditions. The zone thermostat will dictate the amount of cool or warm air necessary to keep its room temperature at the occupant's desired set-point. Therefore, this system will provide inadequate comfort control to all other rooms in the zone since the demand is generated based on the conditions at the thermostat. Overcooling or overheating will likely occur in other rooms.

System Layout with Thermally Powered VAV Diffusers

In **Figure 4,** thermally powered diffusers are used to regulate the air flow within each room. The thermally powered diffuser has an integrated thermostat that reacts to the conditions in that room. A pressure control valve monitors duct static pressure and allows air to bypass the supply duct. This system design gives the occupant the ability to control local space comfort within each room. Because the damper is regulated by a thermal actuator, reaction time to changing conditions will be gradual and stable. The standalone unit is self powered, thus allowing for future layout modifications and requirements. Due to the simple operation of this diffuser, no special training is required for installation and maintenance. Thermal comfort and diffuser performance also are maintained at lower flows.

Networked System Layout with Electronically Powered VAV Diffusers

In **Figure 5**, electronically powered VAV diffusers are used to regulate the air flow within each room. A thermostat or an integrated temperature sensor is located in each space. The electronically powered VAV diffuser actuates based on feedback from the thermostat. A pressure control valve monitors duct static pressure and allows air to bypass the supply duct. BACnet may be utilized for electronically powered VAV diffuser output management and control.

Occupants of each room can control their temperature set-point, thus creating an acceptable space for almost all occupants. As shown in **Figure 5**, an RTU controller can be integrated into the system to allow for polling and heating/cooling strategies to increase energy efficiency and enhanced comfort control.

Figure 3: Conventional diffuser system layout

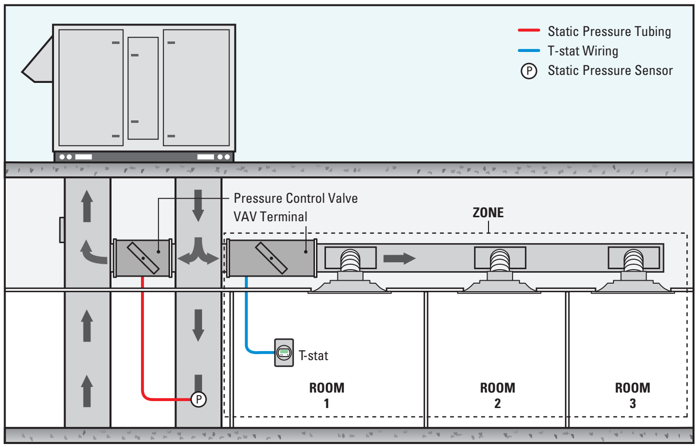


Figure 4: System layout with thermally powered VAV diffusers

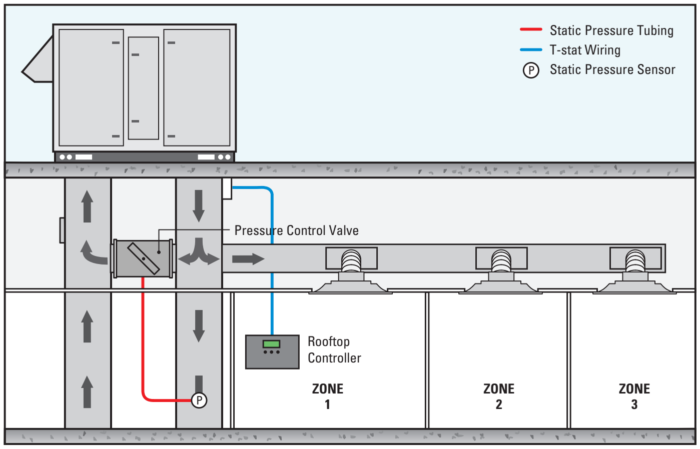
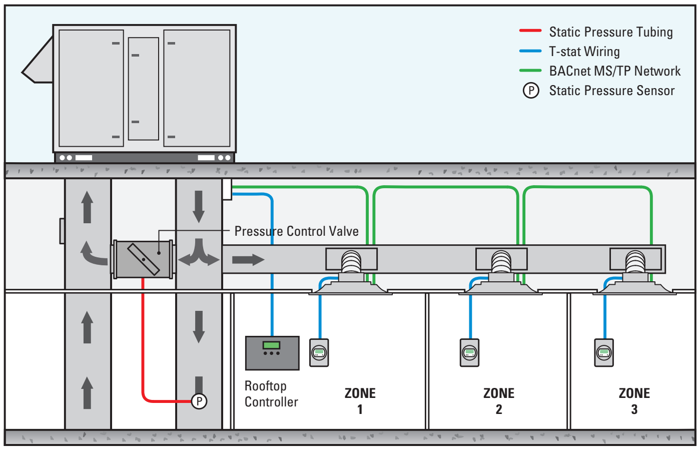


Figure 5: Networked system layout with electronically powered VAV diffusers



CEILING DIFFUSERS

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimeter.

Operating Principles

Coanda Effect

When air passes over a static surface it will follow the surface's profile, providing there are no sharp edges or abrupt changes. This is what is known as the Coanda Effect (**Figure 6**) (ASHRAE, 2009) (Nevin, R. G., 1976). The aerodynamic diffuser backpan ensures that the supply air has a smooth transition from the duct to the room. Supply air leaves the diffuser, adhering to the ceiling as it flows into the space, where it mixes with room air, minimizing air pattern drop. By design, the VAV diffuser backpan and internal damper generate a tight high velocity jet pattern with the Coanda Effect attaching it to the ceiling surface. Without this design, the air flow patterns may detach from the ceiling prematurely and cause thermal discomfort.

Room Air Induction

Induction is the phenomenon of air being drawn towards air in motion. As the speed of air movement increases, the static pressure in the local zone at the diffuser decreases, pulling the surrounding air towards it. This principle is important to the performance of mixing systems; it is the elevated discharge velocity that draws in room air and mixes it with the supply air, as illustrated in **Figure 7** (ASHRAE, 2007b). VAV diffusers rely on high induction to effectively mix the supply and room air to provide uniform room temperature distribution with low room velocities.

No Turn-Down Effects

Conventional systems typically respond to changes to the heating/cooling load by varying the flow of air to the diffusers at low loads. At low loads this can create low velocity air streams at the diffuser, creating the potential for unwanted drafts in the occupied zone (ASHRAE, 2009). VAV diffusers vary the volume of air supplied to a space by modifying the diffuser outlet area. Face velocities are maintained at a more consistent level; high enough to maintain the Coanda Effect and prevent diffuser dumping. Thus, the performance of VAV diffusers is maintained at all load levels due to the consistent face velocities promoting increased room air induction as illustrated in **Figure 8**.

Minimum Air Volume

To meet ventilation rate requirements, the VAV diffuser must be set for a minimum air volume. Both thermal powered and electronically powered VAV diffuser, typically have a means of setting this minimum air volume which can be preset in the factory or adjusted in the field. In some cases, this minimum air volume setting may exceed the cooling load, overcooling the space. To prevent overcooling, some method of introducing heat must be applied. With electronically powered VAV diffusers, the control board can activate perimeter radiation, radiant panels or an upstream duct heater. Thermally powered VAV diffusers will require an additional thermostat to activate heat.

Figure 6: Coanda Effect

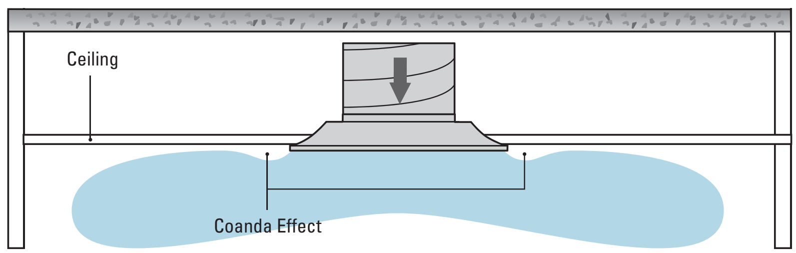
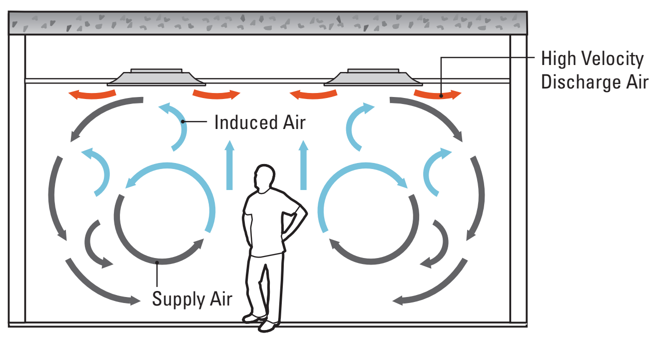


Figure 7: Room air induction

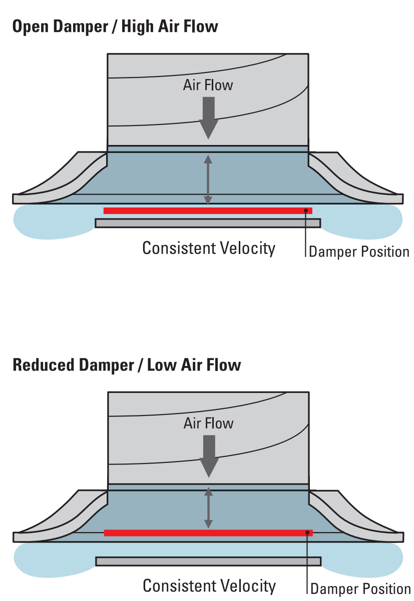


Maintained ADPI

By definition, the air diffusion performance index (ADPI) is the statistical percentage of the points, when measured uniformly within a space, whose local draft velocities and temperatures fall within acceptable comfort limits (ASHRAE, 2007b). An explanation of the ASHRAE method for estimating ADPI and selection procedures can be found in Chapter 9—Mixing Ventilation in the Price Engineer's HVAC Handbook (**Table 1**).

VAV diffusers are designed to maintain a higher ADPI over the full range of movement of their integral dampers within the published operating range. As the damper closes, the air volume discharged from the diffuser is decreased; however, the velocity of the air remains virtually constant due to the resulting reduction in open area. By maintaining the discharge velocity, VAV diffusers ensure good induction and mixing of the room through their operating range. Furthermore, by maintaining the velocity, the throw to 50 fpm is not reduced as much as it is for a conventional air outlet with a constant outlet area, which means the T_{50}/L ratio is not as significantly affected. Therefore, the ADPI value should remain acceptable as the integral diffuser damper modulates.

Figure 8: Face velocities



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Operating Principles

Room Temperature Measurement

Commonly VAV diffusers are designed to operate without a room thermostat, reducing cost, field labor and wiring. Room temperature is measured and controlled based on inducing room air into the diffuser core. During cooling this induced air will be very representative of the occupied zone temperature as the entire room is well mixed due to the high induction characteristics of the VAV diffuser. During heating some stratification of room temperature will exist due to the buoyancy of the warm air, causing a difference in temperature reading between the induced room air and the temperature in the occupied zone. This difference will vary depending on the supply air temperature. The higher the supply air temperature the greater the difference. To correct this temperature difference an “offset” is often applied to more accurately estimate the occupied zone temperature. With a thermally powered VAV diffuser a constant offset is applied in the thermal actuator linkage. Since the actual temperature error varies with air flow and supply air temperature this constant offset will provide limited room control accuracy. An electronically powered VAV diffuser can be programmed to calculate a room temperature offset based on the duct temperature reading to more accurately determine the room temperature in the occupied zone. For applications with limited heating requirements, or for morning warm up sequences the above control strategy will provide acceptable room temperature control. For applications requiring significant hours of heating and where room temperature control is critical an electronically powered VAV diffuser with wall mounted thermostat would be recommended.

Figure 9: Thermally powered diffuser with minimum air flow adjustment

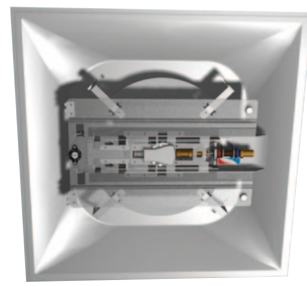

Figure 10: Electronically powered diffuser with heat output on control board

Table 1: Air diffusion performance index (ADPI) selection guide (ASHRAE, 2007b) - IP

Terminal Device	Room Load Btu/hft²	T_{50}/L for Max. APDI	Maximum ADPI	ADPI Greater Than	Range of T_{50}/L
High Sidewall Grilles	80	1.8	68	-	-
	60	1.8	71	70	1.5-2.2
	40	1.6	78	70	1.2-2.3
	20	1.5	85	80	1.0-1.9
Circular[1] Ceiling Diffusers	80	0.8	76	70	0.7-1.3
	60	0.8	83	80	0.7-1.2
	40	0.8	88	80	0.5-1.5
	20	0.8	93	90	0.7-1.3
Sill Grille Straight Vanes	80	1.7	61	60	1.5-1.7
	60	1.7	72	70	1.4-1.7
	40	1.3	86	80	1.2-1.8
	20	0.9	95	90	0.8-1.3
Sill Grille Spread Vanes	80	0.7	94	90	0.8-1.5
	60	0.7	94	80	0.6-1.7
	40	0.7	94	-	-
	20	0.7	94	-	-
Ceiling Slot Diffusers (T_{100}/L)	80	0.3	85	80	0.3-0.7
	60	0.3	88	80	0.3-0.8
	40	0.3	91	80	0.3-1.1
	20	0.3	92	80	0.3-1.5
Light Troffer Diffusers	60	2.5	86	80	<3.8
	40	1.0	92	90	<3.0
	20	1.0	95	90	<4.5
Perforated & Louvered Ceiling Diffusers	11.51	2.0	96	90	1.4-2.7
				80	1.0-3.4

[1]Includes square cone diffuser (SCD) and square plaque diffuser (SPD). Since VAV diffusers are based on the geometry of a square plaque diffuser, they will be included in this category as well.

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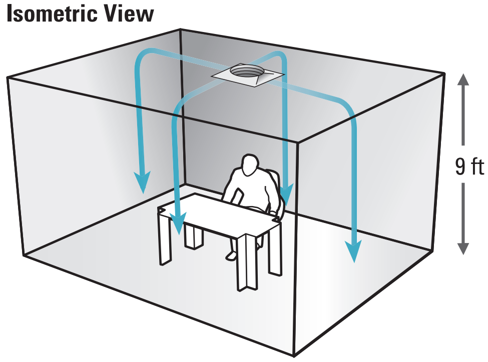
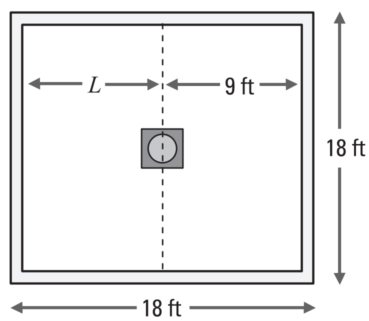
Example 1

In the following example, the ADPI will be evaluated for an electronically powered VAV diffuser and standard perforated diffuser at the same room condition. Consider a 18 ft x 18 ft x 9 ft room with a 24 in. x 24 in. outlet centered in the ceiling.

Isometric View



Plan View



Space Considerations

Some of the assumptions made for the space are as follows:

- Maximum cooling load = 6900 Btu/h or 21 Btu/h/ft^2
- Minimum cooling load = 3100 Btu/h or 10 Btu/h/ft^2
- Maximum flow rate = 376 cfm
- Minimum flow rate = 169 cfm
- A 10 in. inlet neck is selected
- The VAV diffuser will operate at 0.30 in. inlet static pressure
- Characteristic length, L, is 9 ft
- Throw at 50 fpm terminal velocity(T50) is determined from product catalogs

Determine the ADPI at maximum flow from Table 1

Model	L	T_{50}	T_{50}/L	ADPI
Perforated 4 way	9 ft	15 ft	1.7	90
VAV	9 ft	12 ft	1.3	90

Determine the ADPI at minimum flow from Table 1

Model	L	T_{50}	T_{50}/L	ADPI
Perforated 4 way	9 ft	8 ft	0.9	<80
VAV	9 ft	8 ft	0.9	90

Both diffusers provide good ADPI at the maximum flow. At minimum flow, the VAV diffuser has a much greater ADPI compared to the perforated diffuser, which does not achieve the minimum acceptable ADPI level of 80.

VAV Diffusers and LEED®

Incorporating VAV diffusers into building design may contribute to LEED credits. Two credits available when using VAV diffusers are:

Controllability of Systems – Thermal Comfort – IEQ Credit 6.2
The intent of this credit is to provide a high level of thermal comfort system control by individual occupants or groups to support optimum health, productivity and comfort conditions. In order to qualify for this credit, 50% of occupants must have the ability to make adjustments to meet their individual space comfort condition preferences.

VAV diffusers allow personal control of a zone by allowing the user to set the temperature set-point locally, by manually adjusting the diffuser or, in the case of the electronic versions, with the use of an optional thermostat or infrared remote control. These diffusers are the ideal solution for providing personal control in an office environment.

Thermal Comfort – Design – IEQ Credit 7.1
To qualify for this credit the system must provide a thermally comfortable environment that supports the productive and healthy performance of the building occupants in accordance with ASHRAE Standard 55 (ASHRAE, 2004). Under ASHRAE 55, 80% of the occupants must be comfortable in their environment.

VAV diffusers create high room air induction at all cataloged air flow ranges. The increased induction at low air flow eliminates turn-down effects as seen in some standard overhead ceiling diffusers and maintains an acceptable ADPI rating.

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Imperial dimensions are converted to metric and rounded to the nearest millimeter.

Zoning Solutions

Building with Multiple Demands

Buildings often have multiple zones with different air conditioning needs due to local equipment, solar loads, room locations, the number of occupants and the activity level in this space.

A building in the winter can experience varying exterior loads. For this discussion, we will assume the rooftop does have heating capability and three rooms have been identified as needing supplemental heat as shaded blue in Figure11. The south side can be primary cooling, while the north side has a heating load.

Solution 1

If this set of offices only has one rooftop unit and one thermostat, the system can only satisfy one of the cooling/heating requirements. A VAV diffuser can be incorporated into each room to improve individual comfort without additional heating strategies, such as baseboard heat.

Solution 2

Perimeter heat or radiant panels offer another solution to the multiple demand spaces example. The system can be designed so that the Air Handling Unit (AHU) supplies cool air to all diffusers and the perimeter radiation system responds to any requirement for heat (**Figure 12**). If the zone requires no further cooling, the VAV diffusers will move to minimum position, and perimeter heat is activated on a call for heating.

Figure 11: Solution 1 - Zones call for heating and cooling. Rooftop supplies either cool air or warm air.

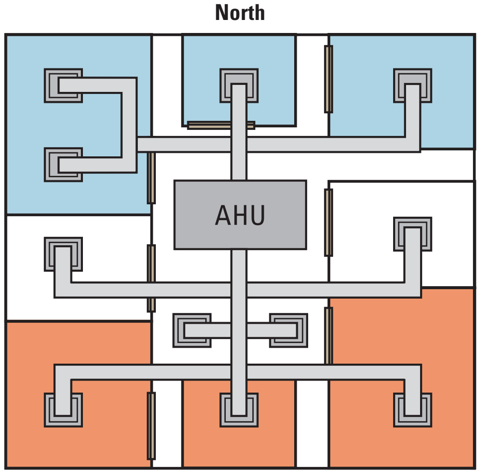
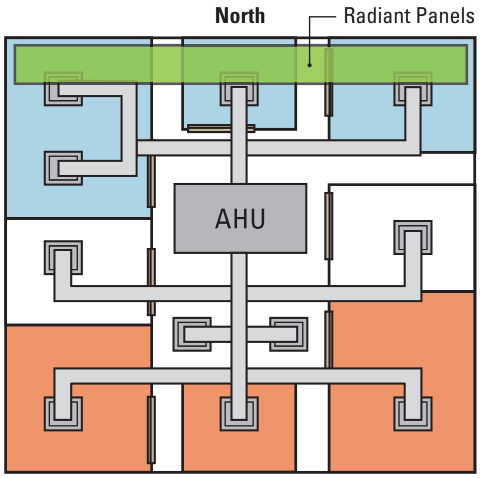


Figure 12: Solution 2 - Perimeter heat or radiant panels, cool supply.



CEILING DIFFUSERS

Example 1

Solution 3

Duct heater stations, an alternative to Perimeter Radiation or Radiant Panels, allow for thermal and ventilation demands in a larger multiple demand zone system (Figure13). For zones that require heating, specific duct heater stations can energize to supply heat to the specific zones rather than supplying hot air from the rooftop to all zones. The zones in which VAV diffusers are located will automatically switch to heating mode (if the option is selected) ensuring that there is adequate zone ventilation for each specific zone demand, and allowing other zones to continue to function in cooling mode. A major drawback for duct heater station design is the additional energy costs required to cool then reheat the air.

Solution 4

By using a rooftop unit with both cooling and heating coils and a DDC rooftop unit controller, BACnet networked VAV diffusers can control the system to supply cooling or heating based on the demand in the various zones or rooms. Weighted and average polling strategies can be used to determine the overall building need for heating and cooling, and control the rooftop unit directly to ensure that these needs are met.

In the example shown in Figure14, the red diffusers require 85% heating, the green diffusers are 100% neutral, and the blue diffusers require 30% cooling.

Under the polling average strategy, the total system demand for the building is shown in Table 2.

In this case, it would not make sense to supply cooling to the blue diffusers since they are a minority with respect to the building's overall heating/cooling requirements. Under this control method, the rooftop would supply heated air until the demand was satisfied.

The advantage of this solution is that it takes into account the size of the demand for either heating or cooling, where the other solutions simply energize heat when there is a demand for heat. This method is more energy efficient.

A drawback of this system design is that not everyone is satisfied as the polling scheme determines when the system is in heating and cooling. However, this can be adjusted through the addition of reheat stations, perimeter heat or multiple AHUs depending on the size of the space. This method of measuring load can be more energy efficient and comfort can be addressed through proper polling schemes.

Figure 13: Solution 3 - Duct heater stations

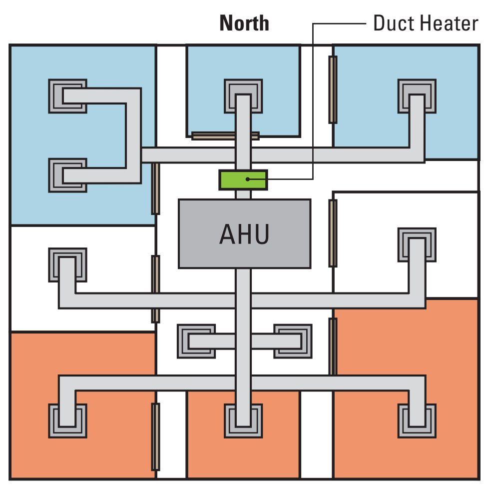


Figure 14: Solution 4 - BACnet network VAV diffusers

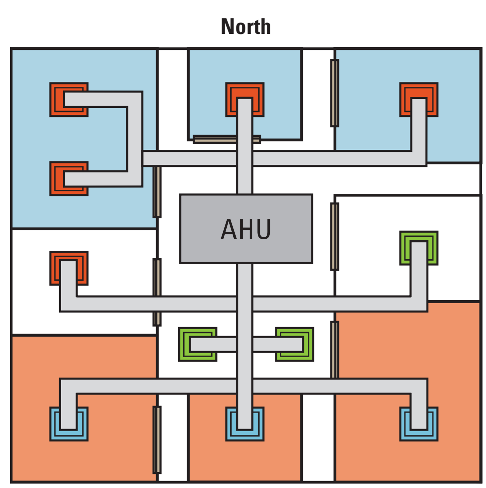


Table 2: Total System Demand for Solution 4

System Demand	
5 x 85%	425% Heat
3 x 30%	90% Cooling
3 x 100%	300% Neutral
Total Demand	**815%**
Heating makes up 425/815	52% of the total
Cooling makes up 90/815	11% of the total
Neutral makes up 300/815	49% of the total

Selection Procedure

Selection of a VAV diffuser is dependent on two main criteria: noise and pressure dependent flow rate.

1. Determine the duct pressure for the system based on pressure drop between the fan discharge and the farthest outlet. The static pressure should be a maximum of ¼ in. w.g. entering the VAV diffuser inlet to minimize the noise generation.
2. Determine the maximum and minimum flow rate to the diffuser based on the room load and ventilation rate.
3. Select the VAV diffuser size from the Modulated Flow Selection Table (see **Table 3**). Under the appropriate design duct pressure column, select the inlet size which will meet the specified sound criteria at the maximum design air volume.
4. Check the cataloged throw values to ensure they match the space requirements. Refer to Chapter 9—Mixing Ventilation in the Price Engineer's HVAC Handbook for further selection information.
5. Once the VAV diffuser size has been selected, note the lowest air volume cataloged under the duct pressure column. This is the minimum limit of the VAV diffuser at the listed static pressure. Check the air volume to ensure it meets the design ventilation rate and also check the throw and noise levels. In some cases, the noise level of the VAV diffuser increases with reduced flow and damper closure.
6. For more information on NC and air distribution selection procedures, please reference Chapter 9—Mixing Ventilation in the Price Engineer's HVAC Handbook.

Note: The VAV diffusers will not operate below the lowest air volume values listed in the Modulated Flow Selection Table (see **Table 3**). Zero minimum or shut-off is not available.

Example 2

In the following example, a VAV diffuser will be selected referencing performance catalog data (**Table 3**).

Space Considerations

Some of the assumptions made for the space are as follows:

Maximum flow = 350 cfm

Minimum flow = 150 cfm

Duct Static Pressure = 0.20 in. w.g.

Max Room NC = 40

Table 3: Performance Data

Performance Data - VAV, 10 in. diffuser						
Inlet Size	**0.10 Duct P_S**			**0.20 Duct P_S**		
	cfm	**Throw, ft**	**NC**	**cfm**	**Throw, ft**	**NC**
6 in.	20	0-0-1	-	28	0-1-2	16
	54	0-1-2	-	79	0-1-3	23
	77	0-1-3	15	111	1-2-3	25
	109	1-2-3	17	152	2-2-4	27
8 in.	46	1-1-3	-	64	1-2-4	24
	112	2-3-5	20	158	3-4-7	31
	170	3-4-7	23	240	4-6-9	33
	242	4-6-9	26	342	6-4-10	36
10 in.	95	1-2-4	23	135	2-3-6	33
	190	3-4-8	26	268	4-6-10	36
	274	4-6-11	28	388	6-8-13	38
	365	6-9-12	29	517	8-10-14	39
12 in.	120	2-3-6	27	169	3-4-8	38
	202	3-4-9	28	285	4-6-11	38
	311	5-7-11	29	441	6-9-13	39
	478	8-10-14	30	675	10-12-17	40
14 in.	139	3-4-8	27	197	4-5-9	36
	213	3-5-9	28	302	5-7-11	37
	370	5-8-12	30	524	8-10-15	39
	555	9-11-15	30	785	10-13-18	40

By interpolating the performance data:

Maximum air flow - 350 cfm - 37 NC - 13 ft throw to 50 fpm terminal velocity

Minimum air flow - 135 cfm - 33 NC - 6 ft throw to 50 fpm terminal velocity

Duct Pressure Control

It is important to control the system pressure for two main reasons. The first is to maintain design noise levels. When some rooms or zones are at low load conditions, diffusers will be forced to throttle off more air to maintain room temperature, creating increased duct static pressure. As the duct static pressure increases, the noise level of the diffusers will increase proportionally. Secondly, as diffusers throttle to reduce air flow to the room or zone, the air flow over the direct expansion (DX) coil is also reduced, potentially causing freeze-up on the coil. Pressure control with a bypass loop will prevent this situation by maintaining constant flow over the coil and limiting duct static pressure to acceptable levels.

The following pressure control methods are commonly used.

Pressure Relief Collar
Pressure relief collars (Green) are a simple mechanical method of controlling system static pressure (**Figure 15**). These collars have bypass gates that are forced open by a predetermined system pressure, shown in **Figure 16**.

When they open, air is bypassed into the ceiling return plenum, thus reducing the static pressure in the supply duct. This method is common with retrofit VAV diffuser applications as installation is simple and does not require extensive system modification.

Care must be taken to ensure that the return air plenum does not over-pressurize and force the bypassed supply air into the occupied space (i.e. exhaust fan or rooftop relief damper).

Discharge Bypass Damper Method
The bypass damper or pressure control valve (Green) is connected to a static pressure sensor, which will actuate the valve when duct system pressure becomes too high, illustrated in **Figure 17**. In this method excess air will be bypassed into the ceiling return plenum, thereby reducing the static pressure. Care must be taken to ensure that the return air plenum does not over-pressurize and force the bypassed supply air into the occupied space (i.e. exhaust fan or rooftop relief damper). The static pressure sensor must be placed at least 3/4 of the way downstream from the control valve to ensure that all pressure losses induced by the ductwork are accounted for (ASHRAE, 2007a).

Figure 15: Equipment layout of pressure relief collar method

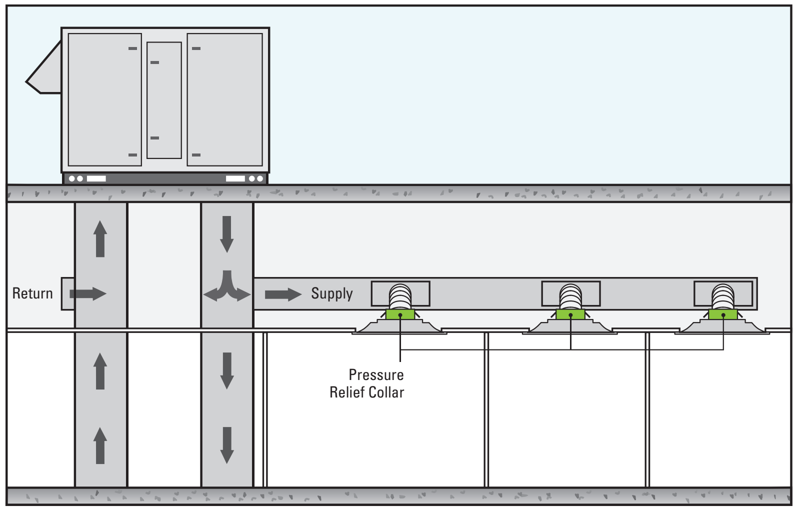
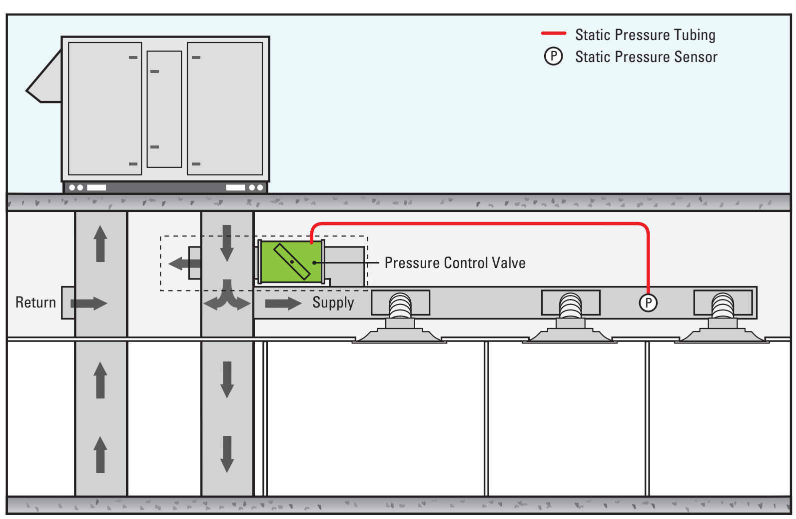


Figure 16: Pressure relief collar

Figure 17: Equipment layout of discharge bypass damper method



Duct Pressure Control

Ducted Bypass Damper Method
This method, illustrated in **Figure 18**, is similar to the plenum return method, except in this case you duct the bypass exhaust terminal or pressure control valve (GREEN) straight to the return ductwork. Since the return ductwork could become pressurized and bypass into the plenum, methods to ensure that the return duct does not get pressurized must be taken (i.e. exhaust fan or rooftop relief damper). The static pressure sensor must be placed at least 3/4 of the way downstream from the control valve to ensure that all pressure losses induced by the ductwork are accounted for (ASHRAE, 2007a).

Fan Control Method
There are two possible methods of fan control that will maintain static pressure in the system. By using a pressure controller (Red) to signal a variable frequency drive (VFD) motor, we can slow down or speed up the flow of air into the space, as illustrated in **Figure 19**. The alternative to the VFD motor is to use inlet vanes. The pressure controller can signal an actuator to close or open the vanes, thus controlling air flow. Fan control should not be used with DX Coils.

The static pressure sensor must be placed at least 3/4 of the way downstream from the control valve to ensure that all pressure losses induced by the ductwork are accounted for (ASHRAE, 2007a).

Figure 18: Equipment layout of ducted bypass damper method

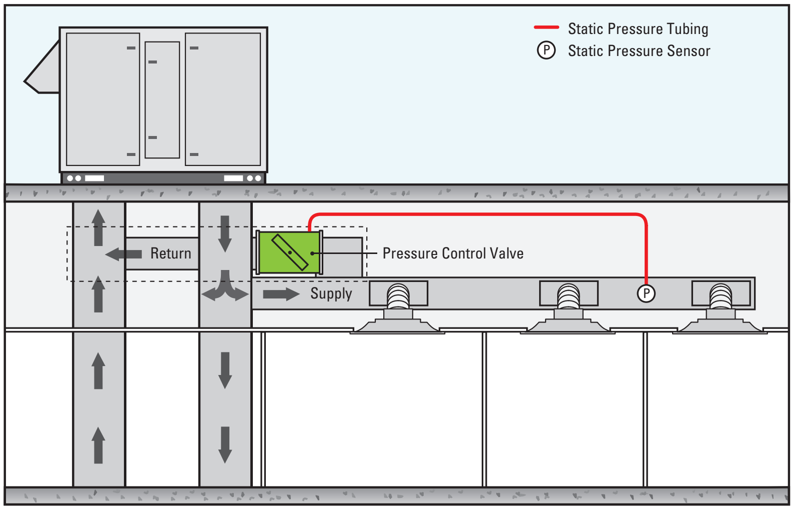
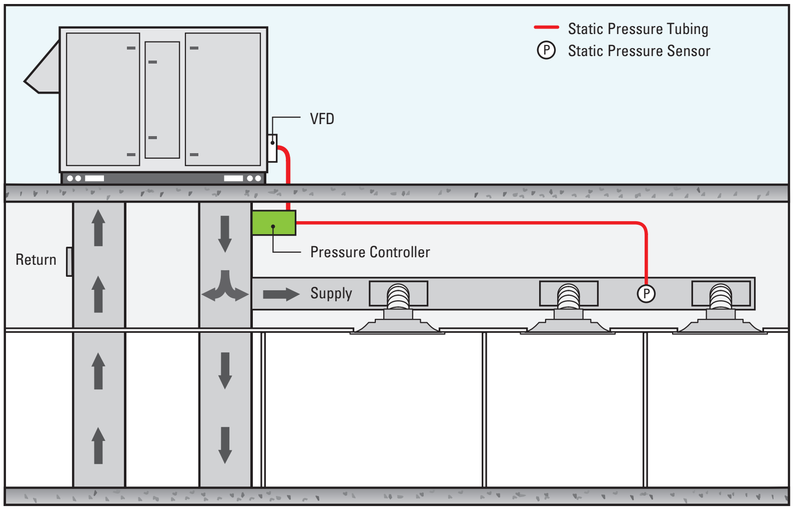


Figure 19: Equipment layout of fan control method



Retrofit Applications

Reduce Thermal Comfort Complaints

When multiple occupants exist in a single zone, chances are one or more people will be thermally uncomfortable. VAV diffusers may be a solution to this problem by subdividing the zone and allowing the occupants to adjust their local zone for temperature. Either thermally or electronically actuated VAV diffusers can be utilized for this. The decision is usually made by weighing the installation requirements versus the type of temperature set-point control desired.

Facility Renovations

Instead of installing terminal units to subdivide a large zone, VAV diffusers are a practical alternative. Both thermally and electronically powered models may be used with the decision mainly based on preference and requirements of the diffusers. If the building already has or is being upgraded to a building management system, the preferred choice would be the electronically powered models, as outputs such as room temperature, supply temperature and damper position would be useful in troubleshooting the HVAC system.

One point to investigate, in either case, is how the system will react, as the proposed VAV diffusers open and close the dampers. As the damper regulates flow, there will be a change in system static pressure. Adding a single VAV diffuser to a large zone may not have much impact on the system. However, replacing a large percentage of diffusers within a zone will cause problems upstream to equipment capacities without proper pressure and flow control being implemented.

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