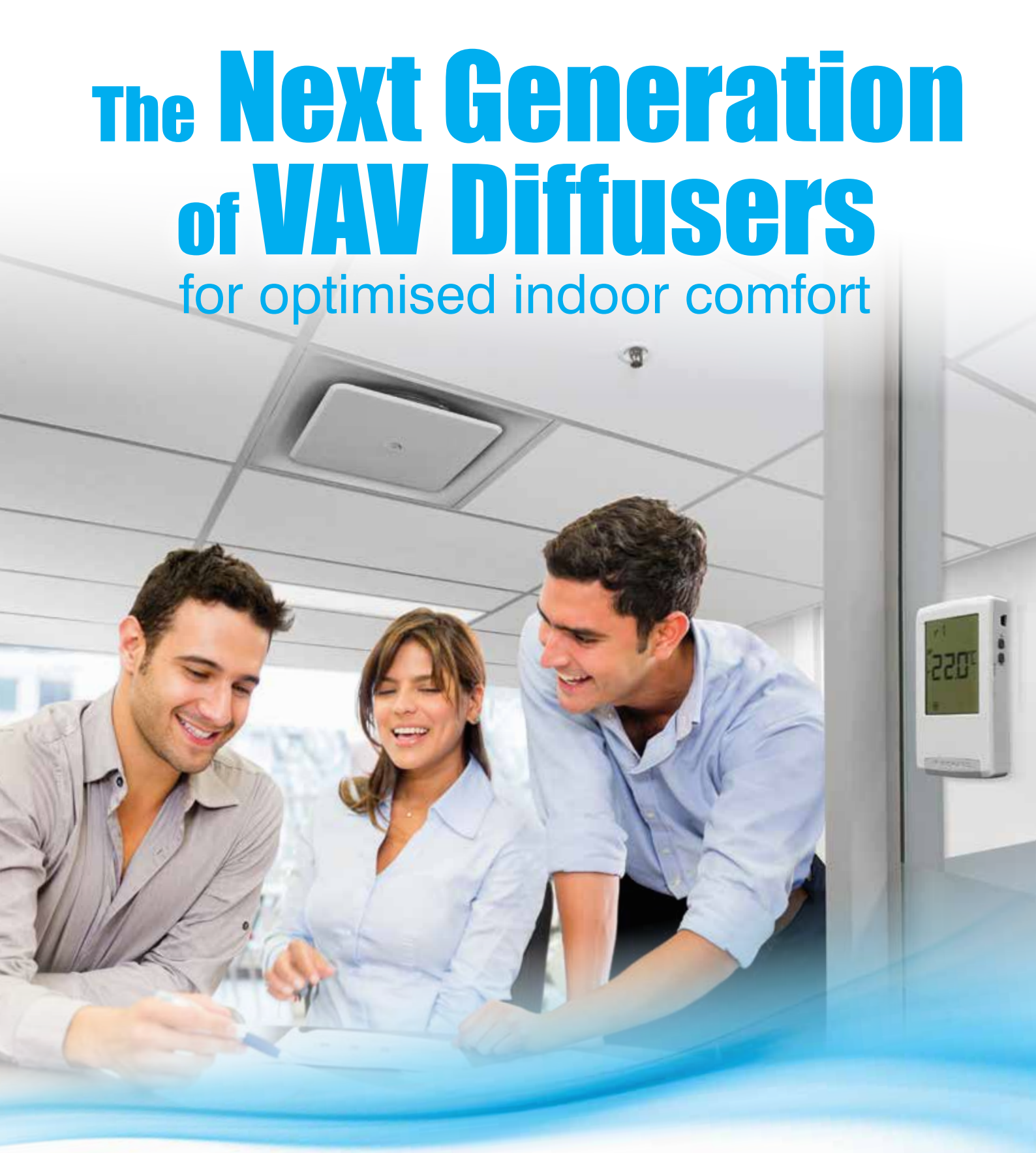
The Next Generation of VAV Diffusers

for optimised indoor comfort



Our next generation of Rickard VAV Diffusers not only provide occupants with optimised thermal comfort, they are also easier to install, and include more features and functionality. These auto zoning diffusers can operate through a BMS or Rickard standalone software, and reduce power consumption by lowering demand on the air handling system.

FANTECH
Intelligent Ventilation

The Drive for Comfort and Energy Efficiency

There is a growing need for products that help create comfortable indoor spaces while maintaining a healthy and productive working environment. At the same time, new government policies and the dramatic increase in energy costs have created greater demand for products and systems that utilize energy efficient technologies. These new demands are now being driven by architects, engineers and developers to create buildings that offer both the optimal working conditions while saving energy consumption and reducing greenhouse gas emissions.

The Rickard range of Variable Air Volume (VAV) diffusers helps meet these demands and is a cost effective system that is simple to operate and very reliable.

Index

Highly Effective Design

Our next generation of Rickard VAV Diffusers provides occupants with optimised thermal comfort and is easier to install. These auto zoning diffusers can operate through a BMS or Rickard standalone software, and reduce power consumption by lowering demand on the air handling system. The system can accommodate a single Rickard VAV diffuser or can be expanded to control thousands of networked VAV diffusers. Since each Rickard diffuser is self-modulating, smaller zones can be easily controlled, making them more comfortable for occupants.
This VAV design, combined with smart commissioning software, enables substantial benefits.

- **Better Thermal Comfort & Air Quality**
- **Enables Capital Expense Savings**
- **Reduces Energy Consumption**
- **Configurable and Flexible VAV System**
- **Streamlined Plug-n-Play Connectivity**
- **Temperature and Occupancy Sensing Standard with Every Diffuser**

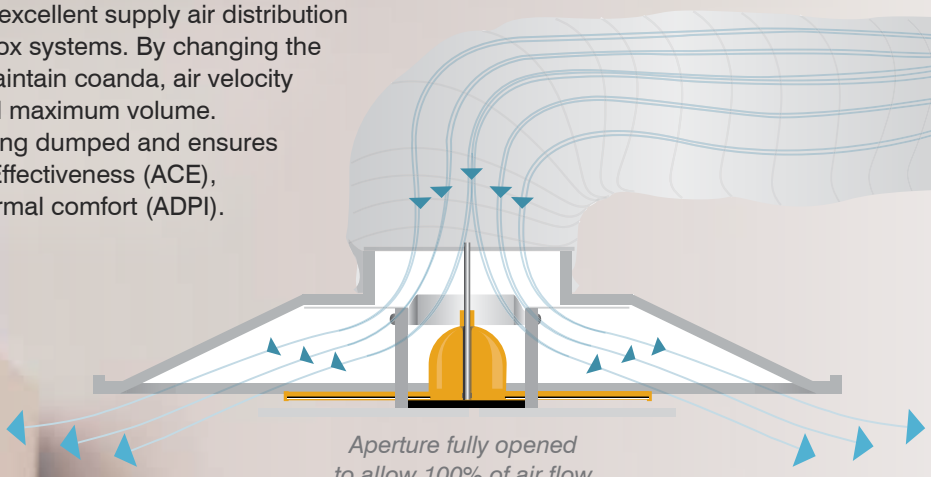
RICKARD
INTELLIGENT COMFORT CONTROL

Better Occupant Comfort and Air Quality

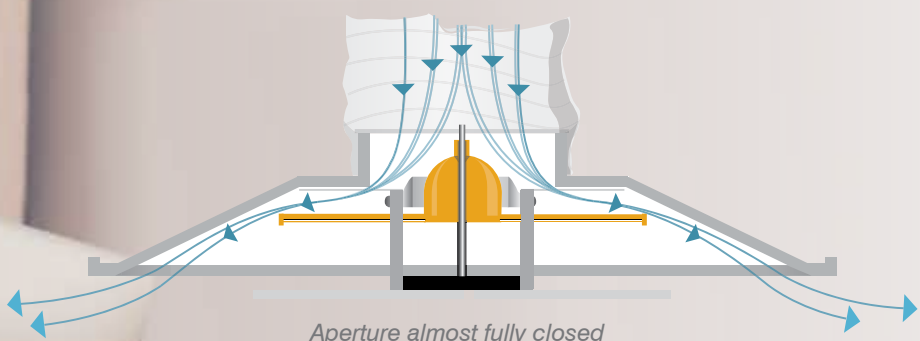
Rickard VAV diffusers help to provide a well ventilated indoor environment that maintains a consistent and comfortable temperature. They eliminate undesirable thermal conditions that can have an effect on output, accuracy and productivity.

Rickard diffusers only allow the required amount of conditioned air to enter the space. This air volume is determined by the temperature in the space and the set-point on the diffuser's in-built temperature sensor or wall thermostat. Each individual temperature set-point can be easily adjusted for the occupant, giving personalised comfort control over the environment.

Rickard VAV diffusers provide excellent supply air distribution compared to traditional VAV box systems. By changing the diffuser's exit geometry, we maintain coanda, air velocity and throw at both minimal and maximum volume. This prevents cold air from being dumped and ensures better air mixing, Air Change Effectiveness (ACE), and consequently, greater thermal comfort (ADPI).



Aperture fully opened to allow 100% of air flow to enter space

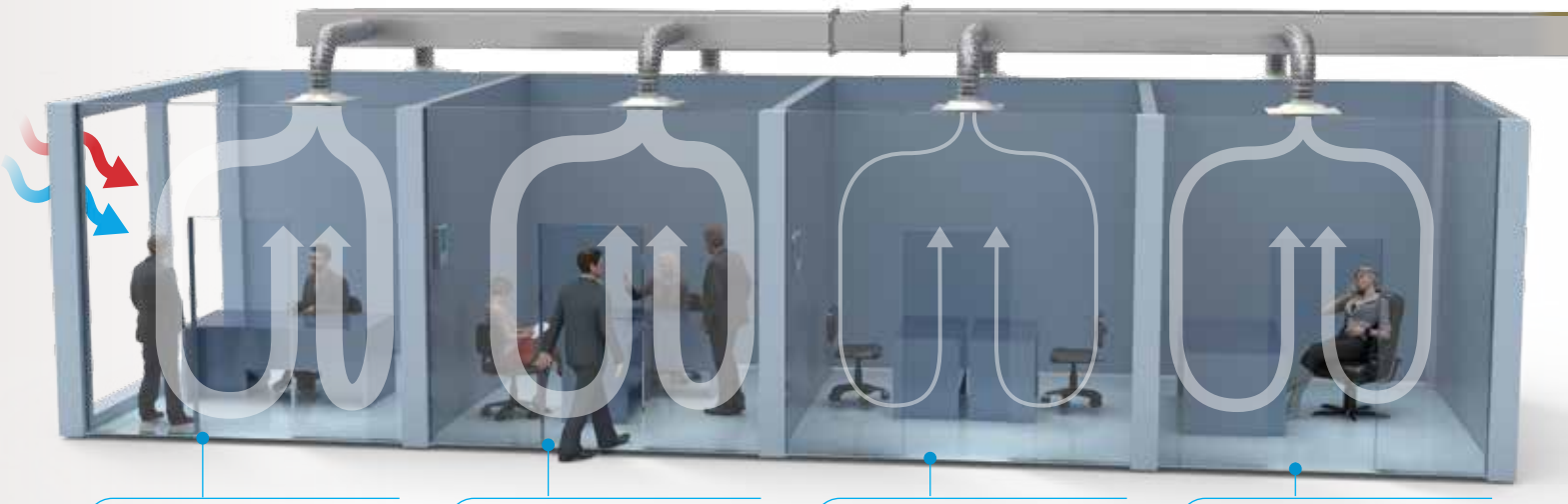


Aperture almost fully closed to allow only 10% of air flow to enter space

Rickard VAV Diffusers compared to a Traditional VAV Box System

Rickard VAV Diffuser System

With individual temperature control in all areas



Optimum Comport

Features individual temperature sensing to meet varying conditions and individual zone control.

Controlled Ventilation

Each Rickard diffuser automatically matches the air supply to the load requirements of an area such as additional staff occupying an office.

Occupancy Sensing

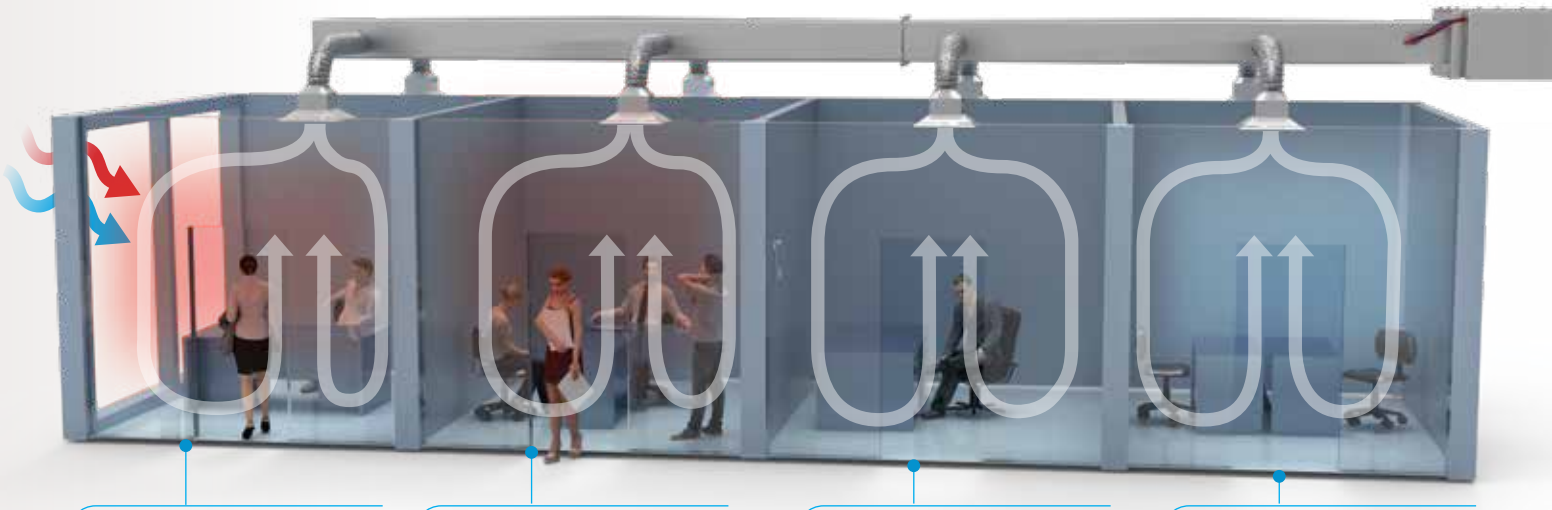
Rickard diffusers with on-board occupancy sensing will automatically back off when a space is unoccupied.

On-board Temperature Sensing

Temperature sensors built into the Rickard diffuser can be used in place of wall thermostats to monitor individual zones.

Traditional VAV Box System

Limited temperature control with one thermostat in areas with multiple offices



Inconsistent Temperature

An office space with external windows becomes too hot or too cold since the centralised thermostat cannot detect fluctuating temperatures.

Too Hot

A thermostat placed away from an area or office cannot detect an increased load such as additional staff occupying the space.

The only Comfortable Office

Typically one thermostat will be allocated for a number of offices. The immediate space with the thermostat is typically the only area that maintains a truly comfortable temperature.

Wasted Heating and Cooling

Traditional VAV box systems can waste energy by over heating or over cooling unoccupied spaces.

Sunshine Coast University Hospital
Project included 4,100 Rickard VAV diffusers installed with onboard air flow sensors

Capital Expense Savings

Rickard VAV diffusers are easy to install and commission, and will function effectively when the building's air conditioning system is in either cooling or heating mode. It reduces capital costs on new building installations since the parallel ducting can be eliminated and duct design simplified. Often the Air Handling Unit size can be also scaled down due to the lower pressure requirements.

Capital Expense Comparison

Based on hundreds of case studies in Australia and New Zealand, the Rickard VAV diffuser system when compared to a typical VAV box system can save an average of 30% on the installation cost. This equates to approximately $11,000 per 1000 m^2.

30% Saving
achieved +

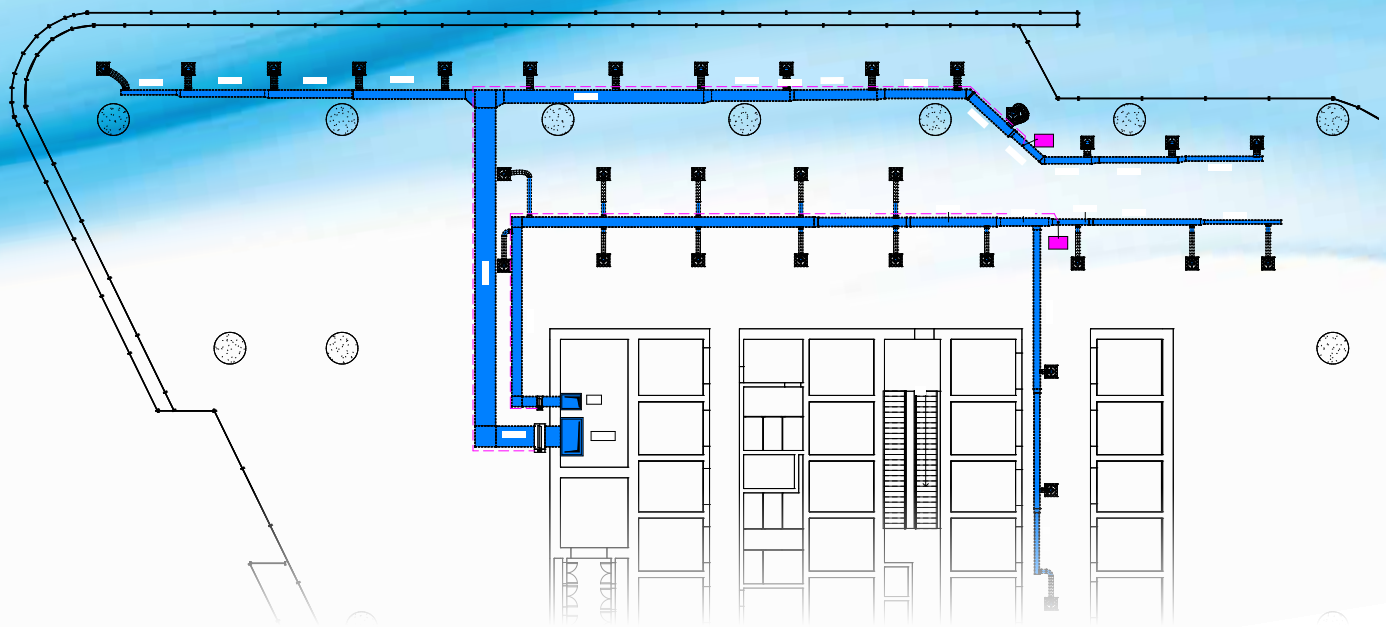
- Parallel ducting is not required to create zones
- Uses a simplified ducting layout
- Less sheetmetal and flex duct required
- A Rickard system doesn't require plenum boxes

Comparing Installation Costs

Indicative installation costs for a VAV Box system and Rickard VAV diffuser system have been compared. Two typical duct runs have been used. One duct run on the perimeter and one duct run in the internal zone.

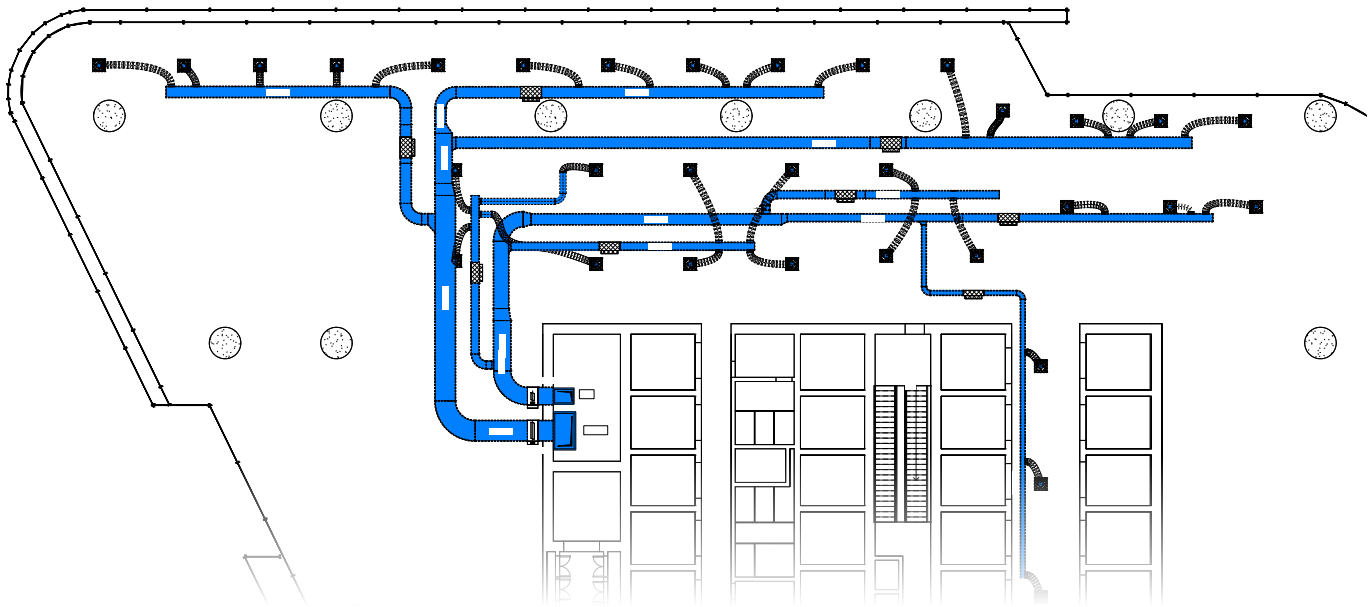
Rickard VAV Diffuser System

Duct Cost	=	$24,900
32 x VAV Diffusers including BMS	=	$13,200
Associated VAV Diffuser equipment	=	$3,720
Installed System	=	**$41,800**



Typical VAV Box System

Ducting Cost	=	$35,100
32 x Constant Volume Diffusers including Plenum Box, Opposed Blade Dampers & balancing	=	$6,800
8 x VAV Plenum Boxes including BMS	=	$13,600
Installed System	=	**$55,500**



An Energy Saving Solution

A key benefit of Rickard VAV diffusers is their ability to reduce the energy consumption of a building by reducing the demand on the air handling system. This is achieved by allowing only the required volume of hot or cold air to enter a conditioned space according to the set point. If the required air volume reduces, the diffuser's aperture size also reduces which creates additional pressure in the ductwork. The accumulated pressure signals to the air conditioning system to slow down which in turn saves fan energy. When the required air volume increases, the diffuser's aperture opens allowing more conditioned air to enter the space.

The incentive for building owners and tenants to have energy efficient rental spaces has never been higher. Rickard VAV diffusers can also help achieve Green Building Credits for Building Management, Indoor Environmental Quality and Energy Efficiency.

Energy Saving Comparison

The Rickard system takes advantage of even pressure duct design. It combines variable air volume diffusers with an intelligent control system to ensure thorough air mixing and substantial energy reduction.

The following VAV Box system and Rickard VAV diffuser system has been compared. Two typical duct runs have been used. The Rickard system requires less pressure throughout all sections of the duct run to achieve optimum performance. This subsequently reduces the load on the fans and air handling units, and enables an energy saving of approximately 30%.

Pressure Reduced from 250Pa to 100Pa

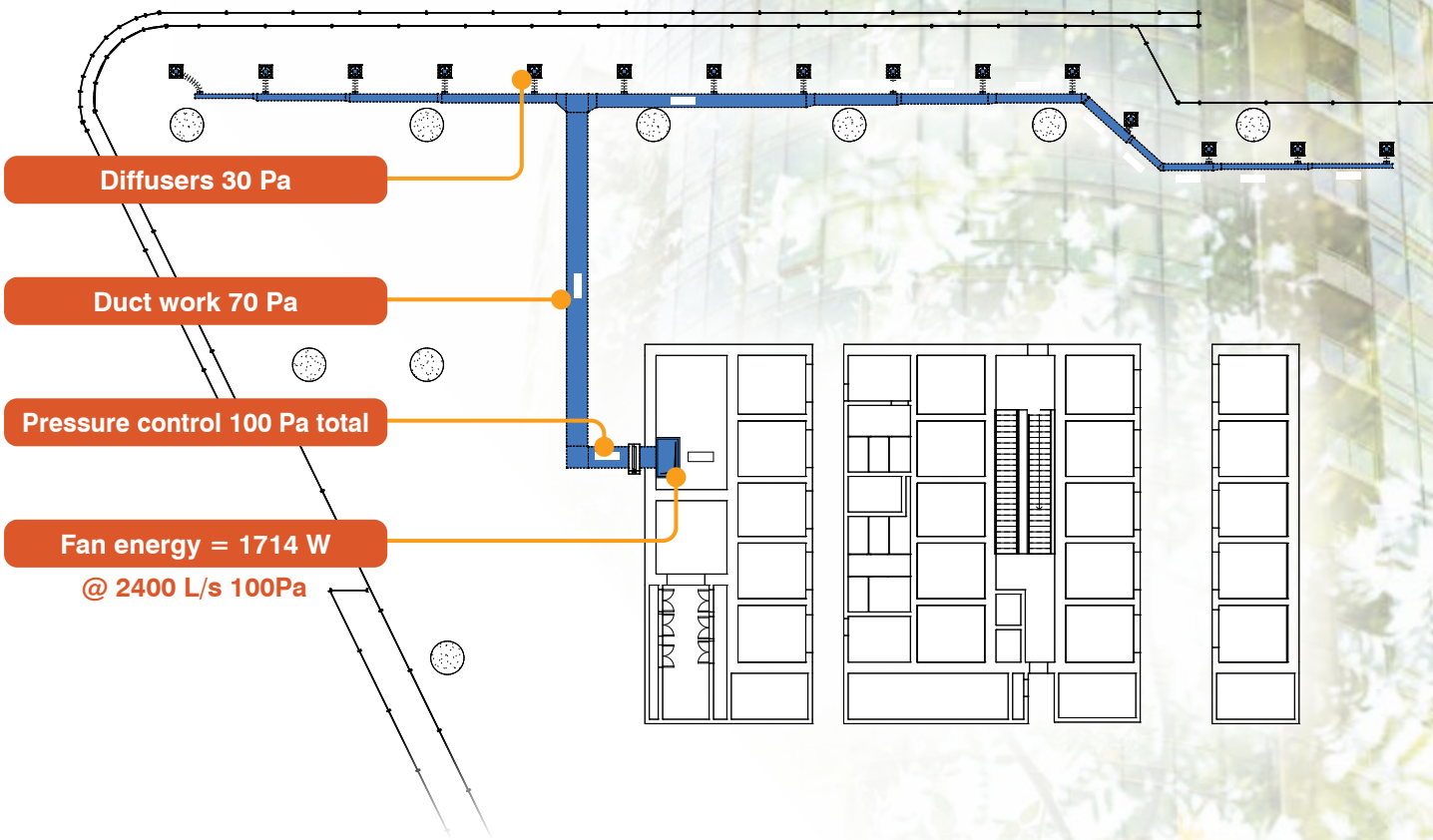
Fan Energy Reduced from 2229W to 1714W

30% Reduced Energy

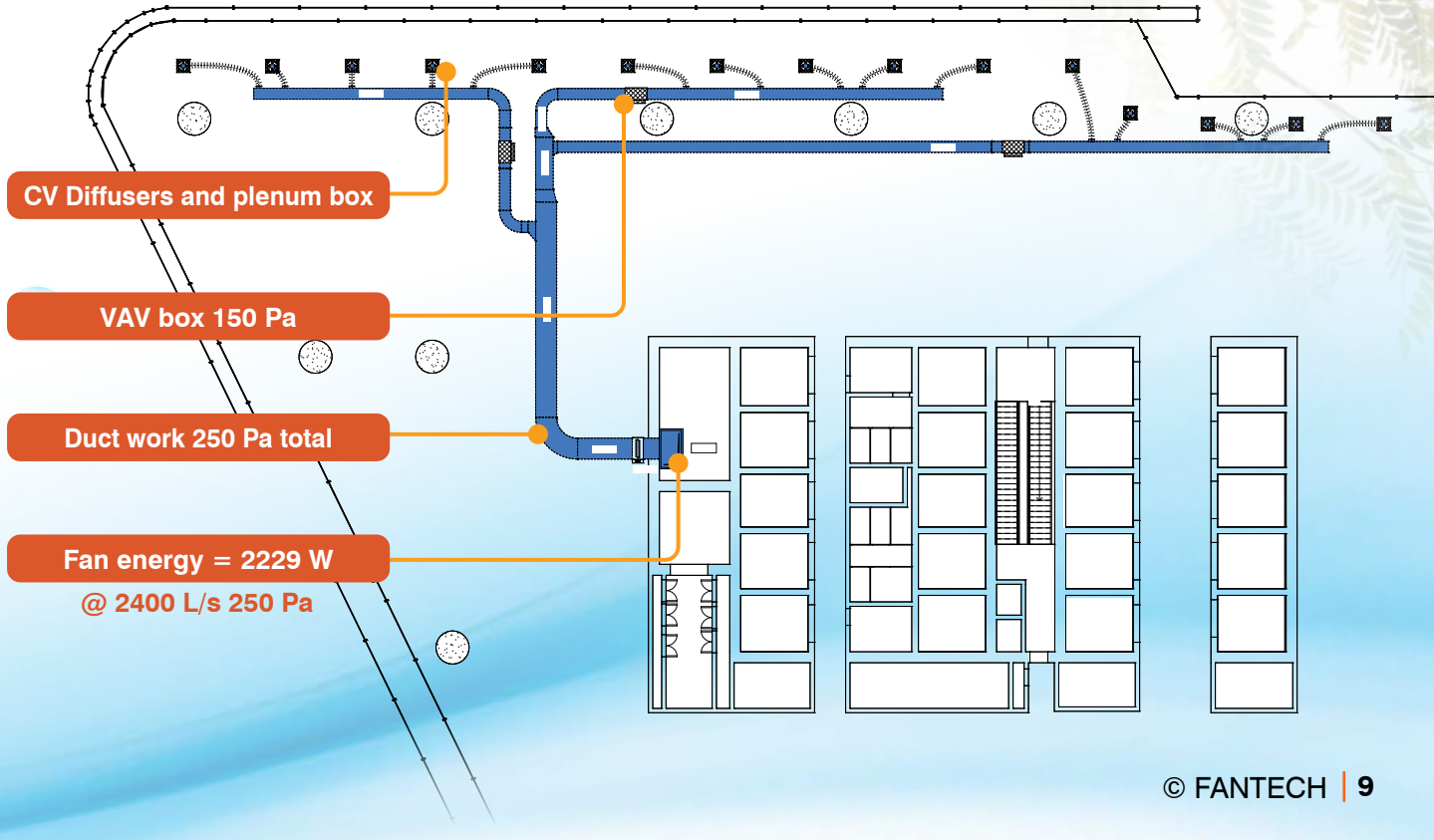
Energy Saved

- A lower pressure duct system reduce the load on the air handling system
- Smaller thermal zones for better thermal comfort control
- Has a lower turndown to match reduced loads

Rickard VAV Diffuser System



Typical VAV Box System



Electronic VAV Diffusers

The Rickard range of VAV electronic diffusers has been developed to be a simple, yet intelligent system that can work on its own or when integrated into a BMS. The system aims to provide better thermal comfort in every part of a building whilst minimising energy consumption and maintaining effective air mixing.

Supply Air Sensor

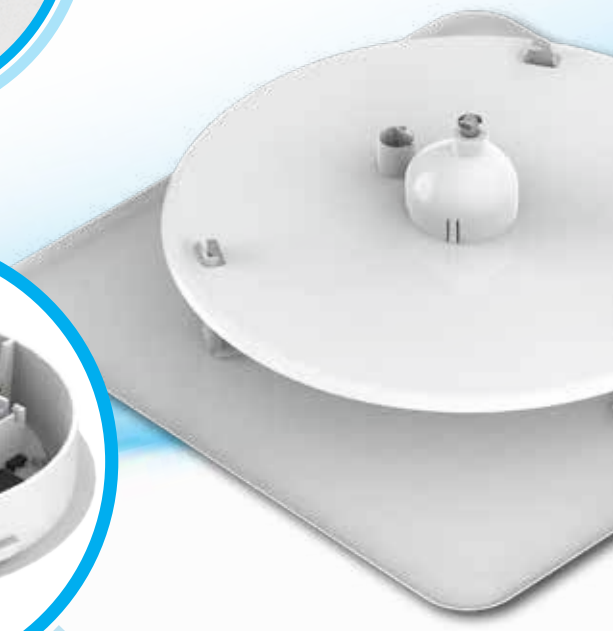
Mounted at the neck of the diffuser as standard to monitor supply air for automatic heating and cooling mode changeover.

Onboard Thermostat

Comes with a built-in thermostat control under the ceiling diffuser faceplate to accurately monitor the temperature within the space.

Onboard Occupancy Sensing

Ceiling diffusers come with occupancy sensing as standard with every diffuser and can be controlled via the Rickard MLM software.



On-board Master Controller

All diffusers come standard with a master controller that uses the MLM software to control the airflow based on the following parameters: supply air temperature, room temperature, and occupancy.

Plug-n-play System

A single daisy-chained, inter-diffuser network cable enables power and communication to all diffusers from a central online system. Each diffuser has an RJ45 terminal for the option to connect a decentralised thermostat.

Built to Last

Rickard diffusers are built with a robust, powder-coated metal construction, including the faceplate, trim-plate, control disc, and foot-mounts. The diffuser interface board is protected with a metal cover and hard-mounted to the diffuser body.

Reduced Commissioning Time

Most Rickard diffusers are set up as masters since it's generally preferred to have individual thermal monitoring and control at each outlet. By default, all diffusers are set to master mode and will automatically assign themselves to their zone when powered up. If a diffuser needs to be assigned as a slave, it can be done using the Rickard MLM software

Faulty diffusers automatically self-isolate to keep the rest of the network running.

Improved hot plug protection makes the diffusers more resilient to plugging in components when powered.

Power supplies have built-in surge protection.

By utilising an all-metal construction, plastic usage within the diffuser has been reduced by 60%.

System Flexibility

The Rickard range of VAV electronic diffusers uses a modular system design that is extremely reliable and easy to install. It can be used with most types of buildings, regardless of their size, due to the simplicity of its design and the flexibility of the system software. It is made up of six core components:

- The Master Communication Unit (MCU)
- On-board master Controller
- Master diffuser
- Wall thermostat
- Diffuser
- Power Supply (PSU)

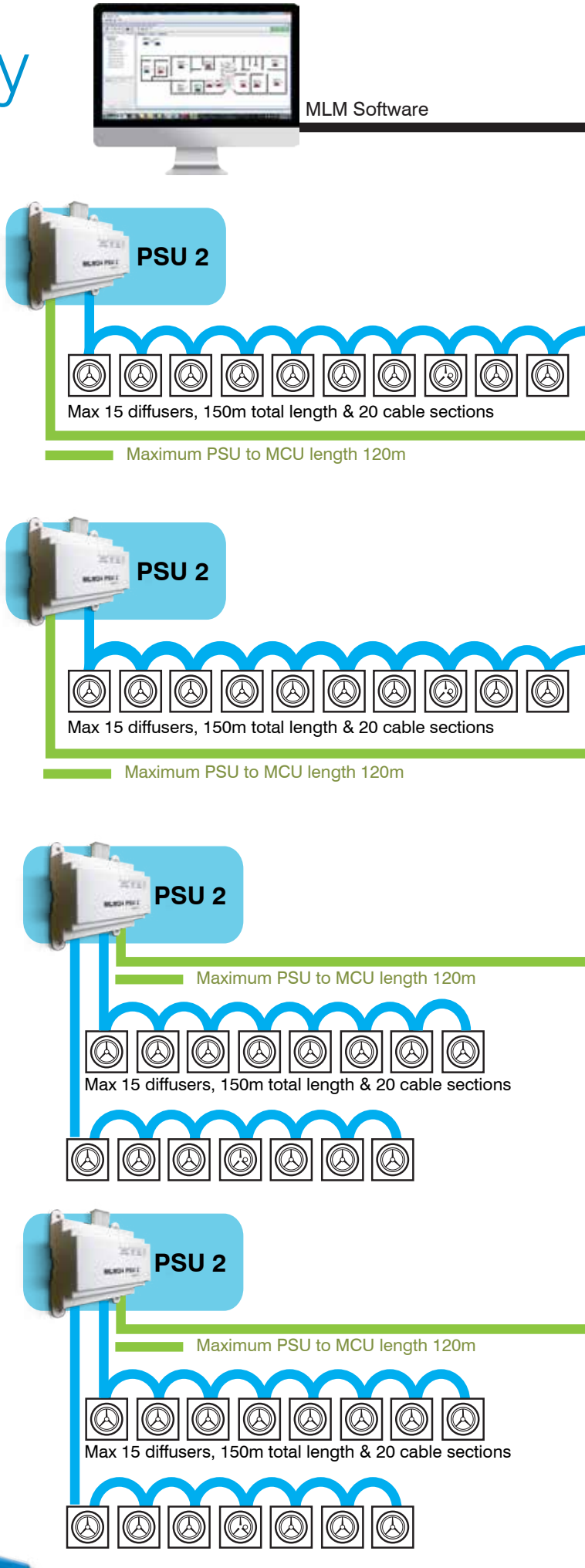
The system can be very simple with one Rickard diffuser, controlled by either the on-board master controller or a wall thermostat.

The system can also be scaled up. A maximum of 60 diffusers can be accommodated on a single Master Communication Unit (MCU) and multiple MCU's can be connected to the BMS if more than 60 diffusers are required. Up to 15 diffusers can be connected to a single power supply, and these can be split into multiple zones.

The diffusers can be individually controlled by either a wall thermostat or the on-board controller that sends its signal back to the BMS. The entire system is then monitored and changes are made through a PC using the Rickard stand-alone software or a BMS.

Rickard Electronic diffusers have adopted an easy to install "plug and play" system that uses simple, automotive grade, daisy chain connections. This helps to minimise the cost of installation and eliminates the risk of using the incorrect connectors.

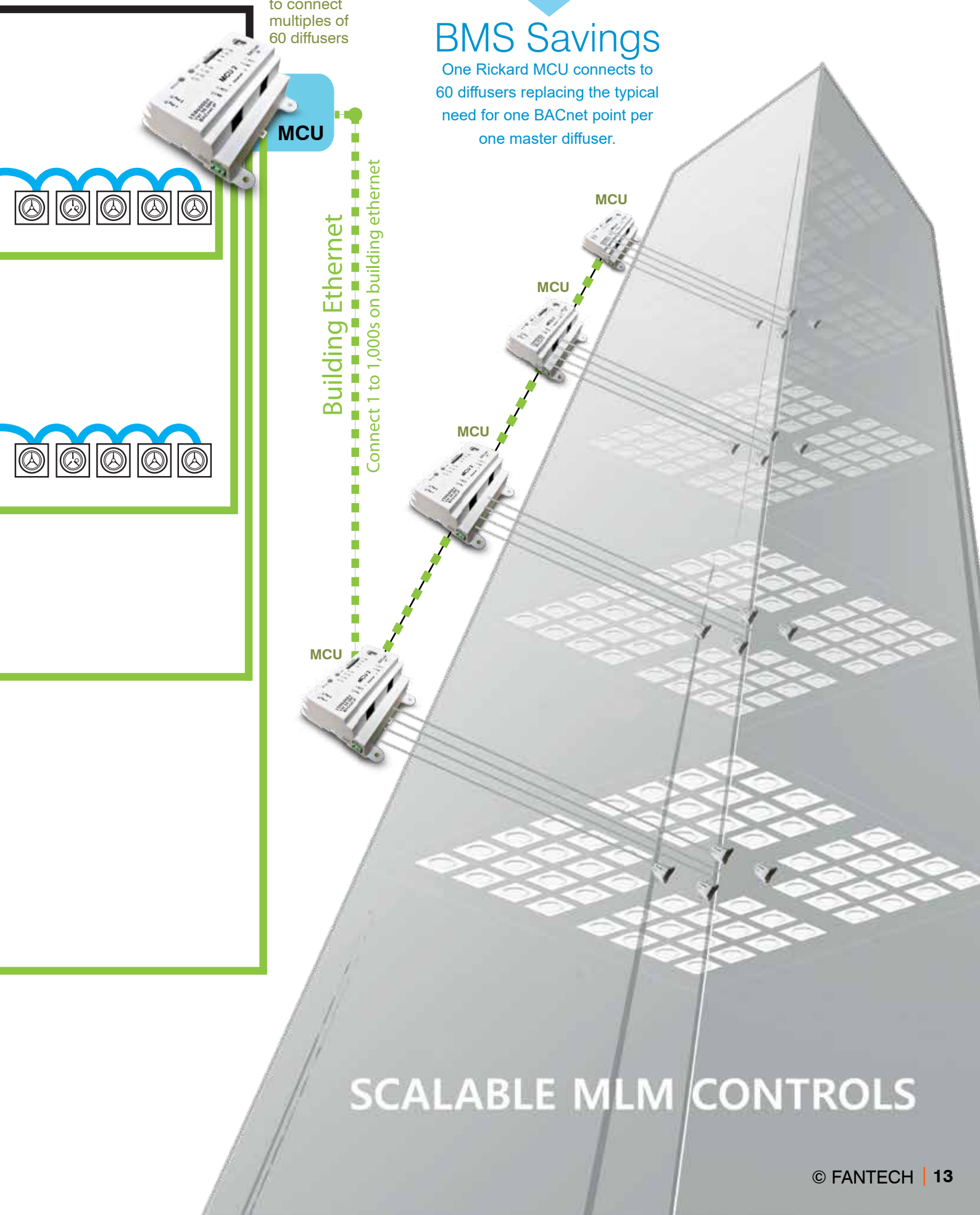
For new installations of Rickard Electronic Diffusers, duct design that achieves static regain is highly recommended. If retrofitting to existing ducting that cannot be changed, a relief ring can be installed at the end of a duct run to release air pressure when the diffusers close.



One IP Address
per 60 diffusers

BMS Savings

One Rickard MCU connects to 60 diffusers replacing the typical need for one BACnet point per one master diffuser.



Easy to Install, Zone and Re-Program

Rickard's MLM software is designed to simplify the commissioning and management of a diffuser network within a building. This software allows for easy configuration of diffuser parameters, monitoring of the network, and logging diffuser activity. The software helps reduce the cost of a BMS connection by decentralising the BMS access point. It controls a single Master Communications Unit using BACnet, connecting up to 60 diffusers in a group and significantly reducing the cost of connection.

With a user-friendly graphic interface, the software provides easy-to-follow instructions and utilises simple color-coded diffuser icons for setup and commissioning. Rickard diffusers are defaulted and installed as a master, with the option to be converted to a slave if needed using the MLM software.

Rickard's feature-filled MLM-installed software allows for individual diffuser communication and monitoring within a building. It includes features such as minimum and maximum temperature control, individual set points, occupancy sensing, diffuser grouping, diffuser isolation (enable/disable), CO_2 monitoring, and fault finding, which contribute to maintaining a well-balanced VAV ventilation system, as well as remote building monitoring and tuning with minimal disturbance to building occupants.

The software also enables users to view up to 60 diffusers at a time, log faults, and centrally detect issues for resolution, providing a comprehensive view of the entire system. Moreover, it offers the ability to visualize the connectivity of each diffuser within a zone and allows users to view data in an easy-to-understand chart by selecting diffuser parameters. The Rickard system can be controlled via the MLM software as a stand-alone ventilation system or can be integrated into a building management system, with the BMS having the capability to override the MLM software when necessary.

Flexible Control Options

Onboard Thermostat

Master Controller

Rickard offers a variety of controllers and sensors that can be integrated into a Building Management System (BMS) to control the HVAC system output based on changing thermal conditions and maintain comfort. These components automatically adjust the HVAC system's operation, modify temperature and airflow volume, and reduce CO_2 levels and demand when spaces are unoccupied.

Each electronic Rickard ceiling diffuser now comes with an onboard thermostat beneath the diffuser faceplate to accurately monitor the temperature within the space. Occupancy sensing is a standard feature with every diffuser.

If a wall thermostat is needed, there are several options available.

Wall Thermostat

The standard wall thermostat is also a master controller which enables the occupant to control the temperature of an allocated space. Typically, the set temperature is displayed and the occupant can select a temperature within a preset range, such as between 20°C and 24°C.

Wall Thermostat with CO_2

The CO_2 wall thermostat has been designed to give accurate room temperature sensing while controlling CO_2 levels via a defined preset level. When the CO_2 value rises above the threshold, the diffusers open fully until the normal CO_2 value is reached. The thermostat can be also monitored by a BMS to adjust the fresh air rates.

Wall Thermostat with Occupancy Sensing

Occupancy sensing is standard in every electronic Rickard VAV diffuser and available as an option with the wall thermostat. When a room with Rickard occupancy sensing is vacant, the diffuser will automatically reduce the supply of air to that room. If the room becomes occupied, the diffuser will return to automatic control. If the diffuser with occupancy sensing is connected to a BMS, it can also automatically control the room lights.

Wireless Controls

A Rickard system with wireless controls is designed to reduce the use of cable connections and allow location flexibility of controllers and sensors. Whether it's at installation stage or rearranging an existing floorplan, Rickard wireless controls and sensors, can be placed anywhere within the building without disruption to the building's structure or occupants.

Wireless Access Point

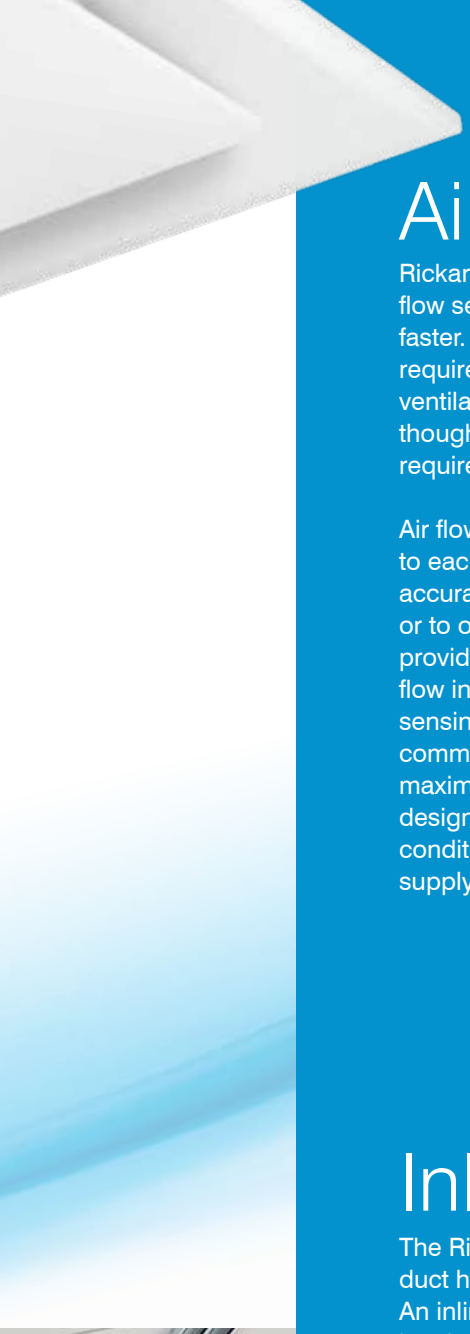
A wireless Access Point (AP) can communicate with up to 15 wireless wall thermostats and POD temperature sensors. Multiple Access Points can be used to match specific project requirements. Commissioning is made simple with Rickard MLM software and its intuitive thermostat/diffuser pairing feature.

Wireless Wall Thermostat

The wireless wall thermostat provides individual temperature control and sensing without compromising on floor plan changes, as well as helping to reduce the cost of installation. Typically batteries in a wireless wall thermostat have a 3 year life span.

Wireless POD Temperature Sensor

The POD sensor provides room temperature sensing with wireless capability making it quick and easy to install. The sensor acts as a remote sensing station that can be easily moved if a diffuser needs to be relocated. Typically batteries in a wireless POD temperature sensor have a 5 year life span.



Air Flow Sensor

Rickard electronic ceiling and linier diffusers are available with air flow sensing that enables commissioning to occur easier and faster. Every room can now supply the precise amounts of air required via a unique air trimming feature. It allows the ventilation system to be electronically tuned remotely though the Rickard MLM software without the requirement of an Air Capture Hood.

Air flow sensors can be fitted to each Rickard diffuser for accurate air flow calculations or to one diffuser per zone to provide an indication of air flow in that zone. The air flow sensing feature also includes a commissioning mode that allows a maximum flow value to be limited to design volumes under maximum load conditions. This ensures the diffuser does not supply more air than intended.

Inline Duct Heater

The Rickard VAV diffuser system can include electric inline duct heaters if additional heating is required for particular zones. An inline heater can help reduce the energy consumption in a building. By using them for offices that are typically colder than the buildings average, it reduces the load on the central heating system.

- Fitted between the main duct and the diffuser flex duct
- Adjustable output to ensure stratification doesn't occur
- MLM and BMS compatible

Square/Round Electronic VAV Ceiling Diffusers

Rickard electronic ceiling diffusers are available in 3 distinctive styles: Square, Round and Swirl. The Square and Round style diffusers produce low noise levels and are designed for general building zones where uniform radial discharge is the preferred supply air distribution pattern. The Swirl style diffuser is a more efficient solution for generating high induction between supply and room air.

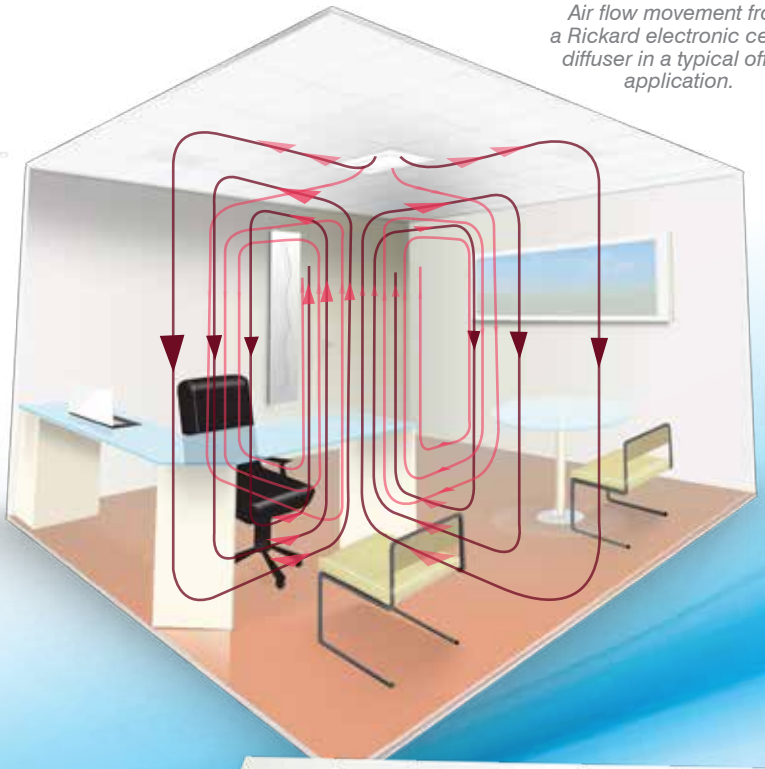
Room temperature is controlled and maintained by varying the supply air volume in accordance with demand. Air volume control is achieved through the vertical up and down movement of the control disc mechanism within the diffuser. This increases or decreases the aperture size which allows more or less air to enter the occupied space. This effectively maintains constant air movement in the room at discharge volumes from 100% down to approximately 10%. An electric actuator drives the position of the control disc in response to a signal received from the temperature sensor.

All electronic ceiling diffusers are available in the industry's most popular neck sizes; 150, 200, 250 and 300mm diameters. The square and round style diffusers include an additional 350 diameter neck size. There are 2 overall diffuser sizes available. VSD, VCD and VSW models are offered in a 595 x 595mm finished size, while the VRD and VRW come in a 580 diameter size. All electronic ceiling diffusers are available with an in-built occupancy sensor.

Square to Square diffuser

Square to Round diffuser

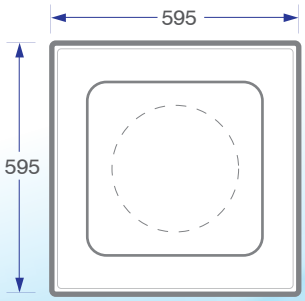
Range dimensions



Air flow movement from a Rickard electronic ceiling diffuser in a typical office application.

Square to Swirl diffuser

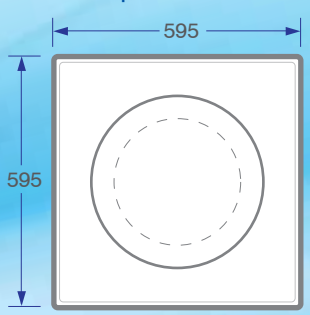
VSD - Square to square style



Neck/Spigot size:

Ø150
Ø200
Ø250
Ø300
Ø350

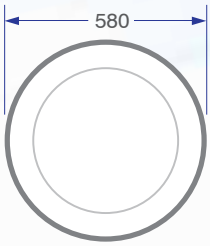
VCD - Square to round style



Neck/Spigot size:

Ø150
Ø200
Ø250
Ø300
Ø350

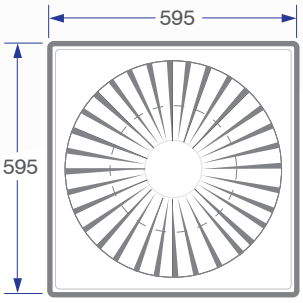
VRD - Round to round style



Neck/Spigot size:

Ø150
Ø200
Ø250
Ø300
Ø350

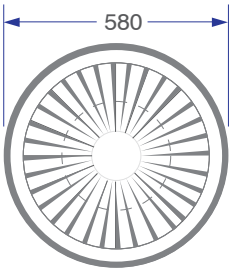
VSW - Square to swirl style



Neck/Spigot size:

Ø150
Ø200
Ø250
Ø300

VRW - Round to swirl style



Neck/Spigot size:

Ø150
Ø200
Ø250
Ø300

Dimensions in mm

Linear Slot Electronic VAV Ceiling Diffusers

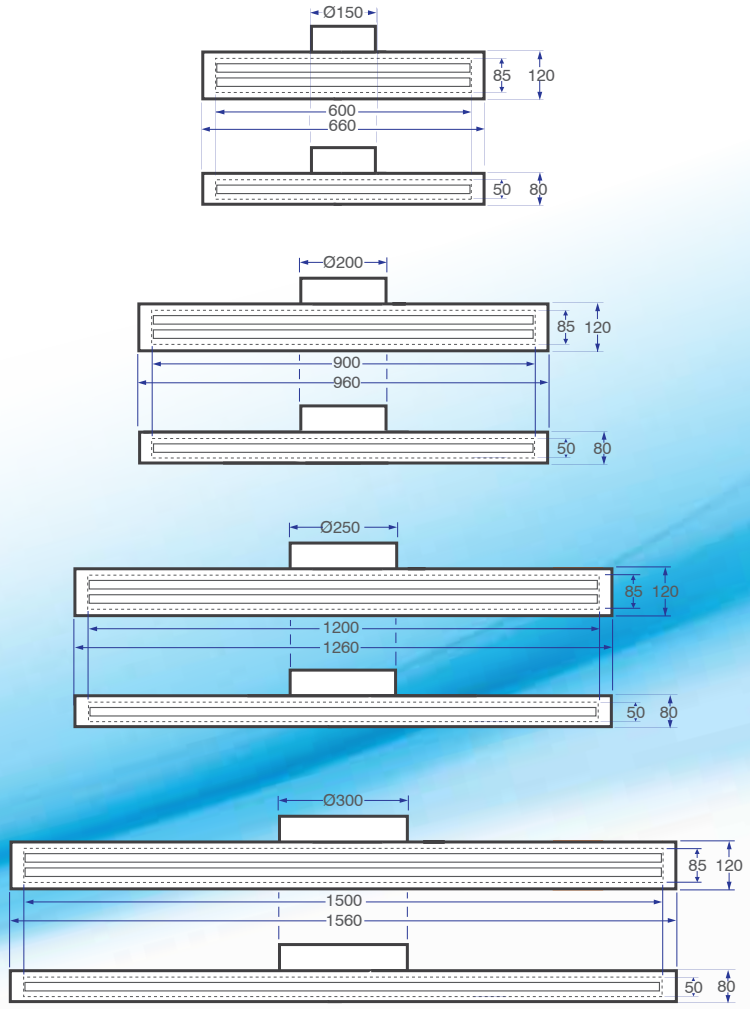
Rickard linear slot diffusers provide an effective means of distributing conditioned air into the perimeter zones of a building where the temperature control requirements are the most demanding. The slim, attractive shape of the diffuser ensures that its subtle design works with most architectural styles. At the same time its superior aerodynamic design ensures that the air distribution creates no drafts, is quiet and highly efficient.

A linear slot electronic VAV ceiling diffuser must be connected to a wall thermostat (temperature sensor) for it to perform as a master diffuser. The diffuser can then operate with one or more slave diffusers, or as a standalone system to provide the required amount of conditioned air to the area. This amount of conditioned air is determined by the temperature in the space and the set point on the wall thermostat.

Air volume control on the linear slot diffuser is achieved with the opening and closing of vanes driven by an electric actuator. This increases or decreases the aperture size which allows more or less air to enter the occupied space. This will effectively maintain a comfortable temperature at discharge volumes from 100% down to approximately 10%.

VLN - Range dimensions

One and two slot styles

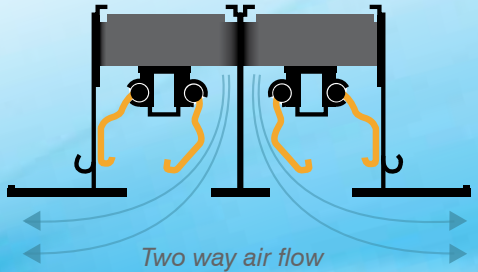


Dimensions in mm

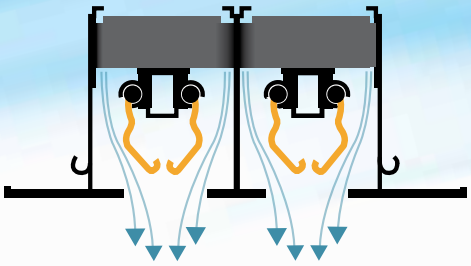
3 and 4 slots also available

The air flow direction from the diffuser can be changed so it blows in the opposite direction, the same direction, or vertically downward for better room penetration in rooms with high ceilings. These changes can be made easily by the occupant from below the ceiling without affecting the diffuser's performance.

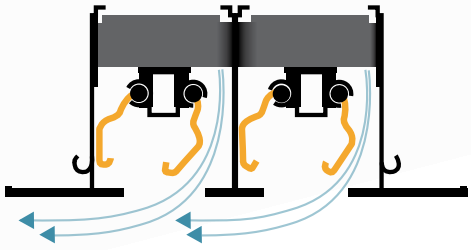
Air flow direction



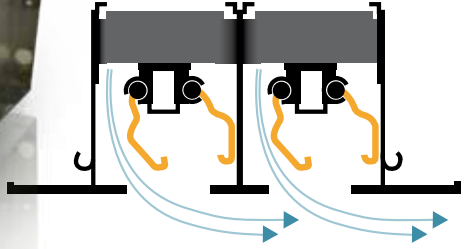
Two way air flow



One way air flow - downward



One way air flow - left



One way air flow - right

Electronic Wall/Bulkhead VAV Diffusers

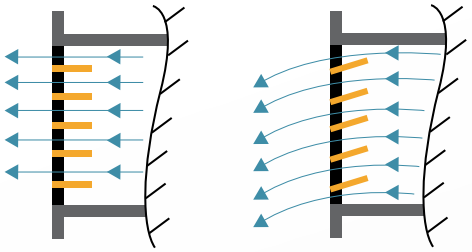
The Rickard electronic wall/bulkhead VAV diffusers are normally used in sidewalls or bulkheads where restricted ceiling voids exist or covered ceilings are not available. They are very effective at distributing air across long offices, but when only a short distance is required, the angle of the double deflection blades within the housing are simply adjusted to change the direction of the throw.

A comfortable room temperature is maintained by varying the supply air volume in accordance with demand. This is achieved by opening or closing the diffuser's aperture which is a set of air foil shaped aluminium vanes, driven by a 24V AC electric actuator.

Like the linear slot electronic diffusers, the movement of the vanes is determined by the temperature in the space and the set point on the wall thermostat. Depending on the demands required, these diffusers maintain air volumes ranging from 100% to 10% which effectively mix the air and maintains a more healthy and productive environment.

The electronic wall/bulkhead diffusers are available in 2 heights, 100mm and 150mm. The 100mm size is available in lengths from 300 to 650mm and the 150mm size comes in lengths from 500 to 800mm.

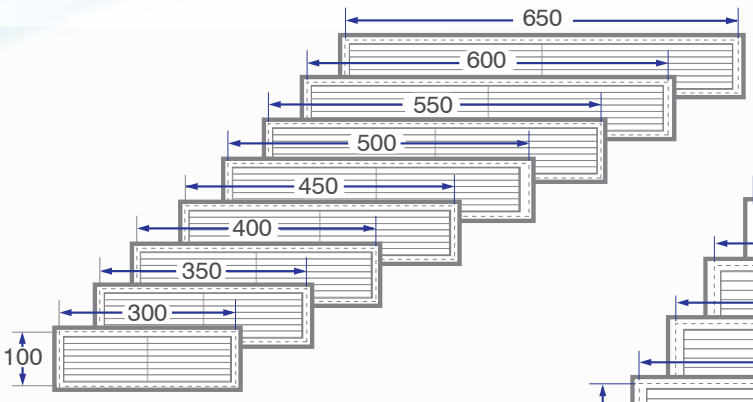
The wall/bulkhead diffuser has no in-built temperature sensor so it must be connected to a wall thermostat for it to be changed to a master diffuser. The diffuser can then operate with one or more slave diffusers or as a standalone system to provide the required amount of conditioned air to the area.



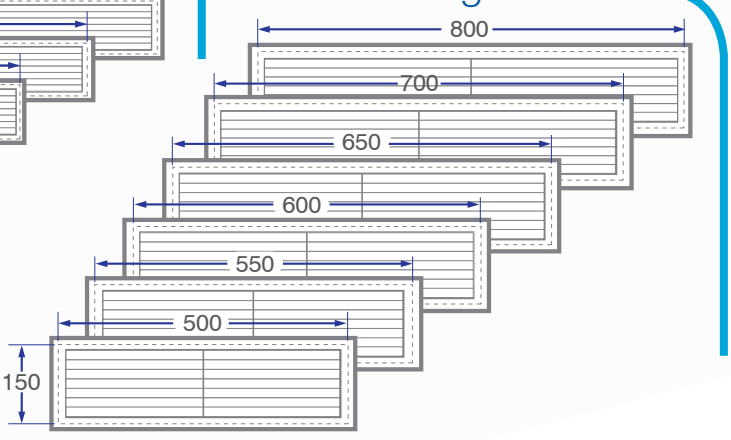
Angle of the blades can be adjusted to change the direction of throw.

WBD - Range dimensions

100mm height



150mm height




Education and
Research
Centre

Thermo-Disc VAV Ceiling Diffusers

The Rickard thermo-disc ceiling diffuser is a mechanically controlled, thermally powered VAV diffuser. It requires no external temperature sensors such as a wall thermostat as each diffuser contains its own in-built temperature sensing and volume control mechanism.
Its overall appearance and construction is very similar to the electronically controlled diffusers, but has the advantage that it requires no external wiring or power supply.

As with the electronic version, air volume control is achieved through the vertical up and down movement of the control disc within the diffuser. In the case of the thermo-disc diffuser, this movement is caused by the expansion and contraction of the diffuser's mechanism at set temperatures.
This increases or decreases the aperture size which allows either more or less conditioned air to enter the space and effectively maintain a constant air movement from 100% down to 25% of maximum air volume.

Setting and adjusting the room temperature set point is easily achieved by rotating the adjustment rings; blue ring for cooling and red ring for heating. The rings have calibrated temperature markings from 19°C to 24°C to suit individual occupant choice. To access these rings when installed, occupants simply rotate the diffuser trim-plate counter-clockwise and remove it from the diffuser back pan.

Thermo-disc Diffuser Components

1. Thermal Mechanism
2. Room Temperature Set-point Adjustment Ring (Cooling mode)
3. Induction Tube
4. Room Temperature Set-point Adjustment Ring (Heating mode)
5. Control Disc Minimum Stop Adjustment Ring
6. Control Disc
7. Diffuser Trim-plate
8. Diffuser Backpan

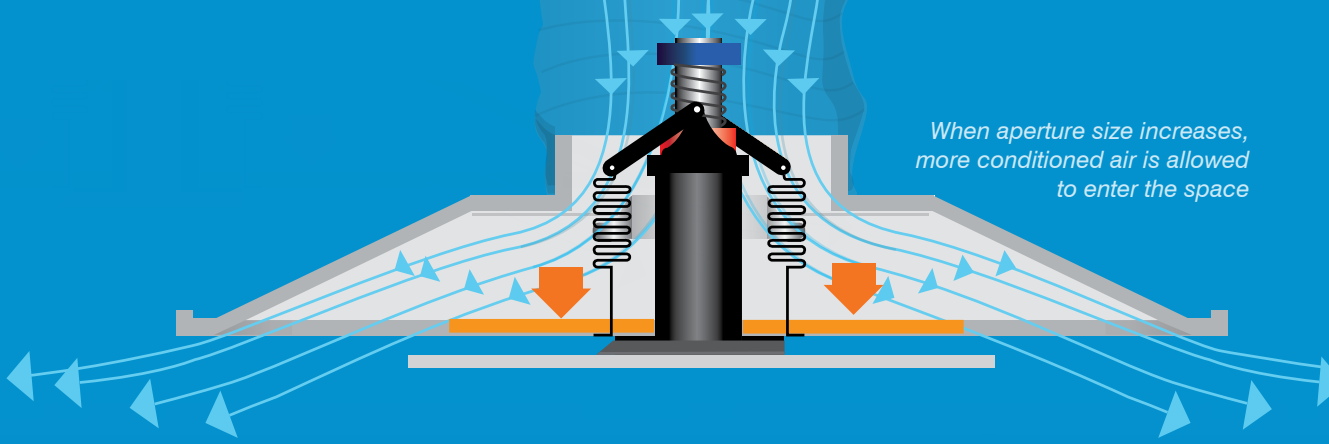
595 X 595mm Square to Square diffuser

Neck/Spigot size:
Ø150
Ø200
Ø250
Ø300

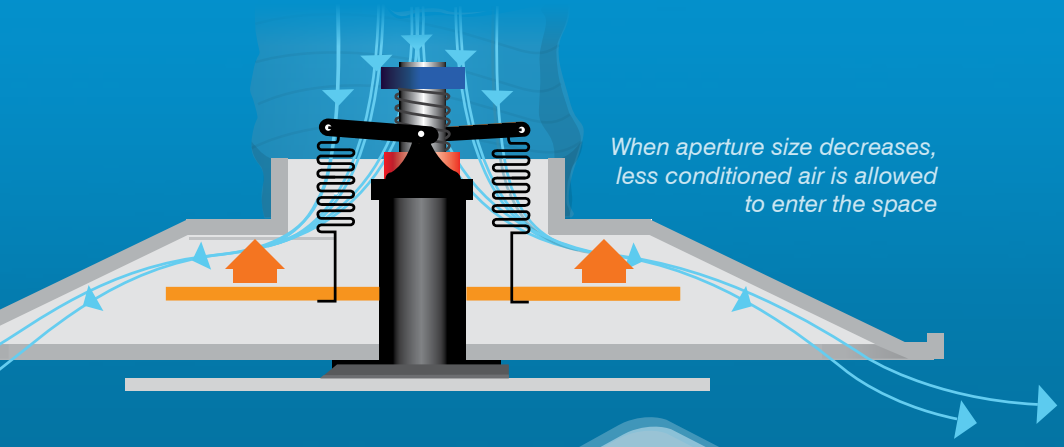
595 X 595mm Square to Round diffuser

Neck/Spigot size:
Ø150
Ø200
Ø250
Ø300

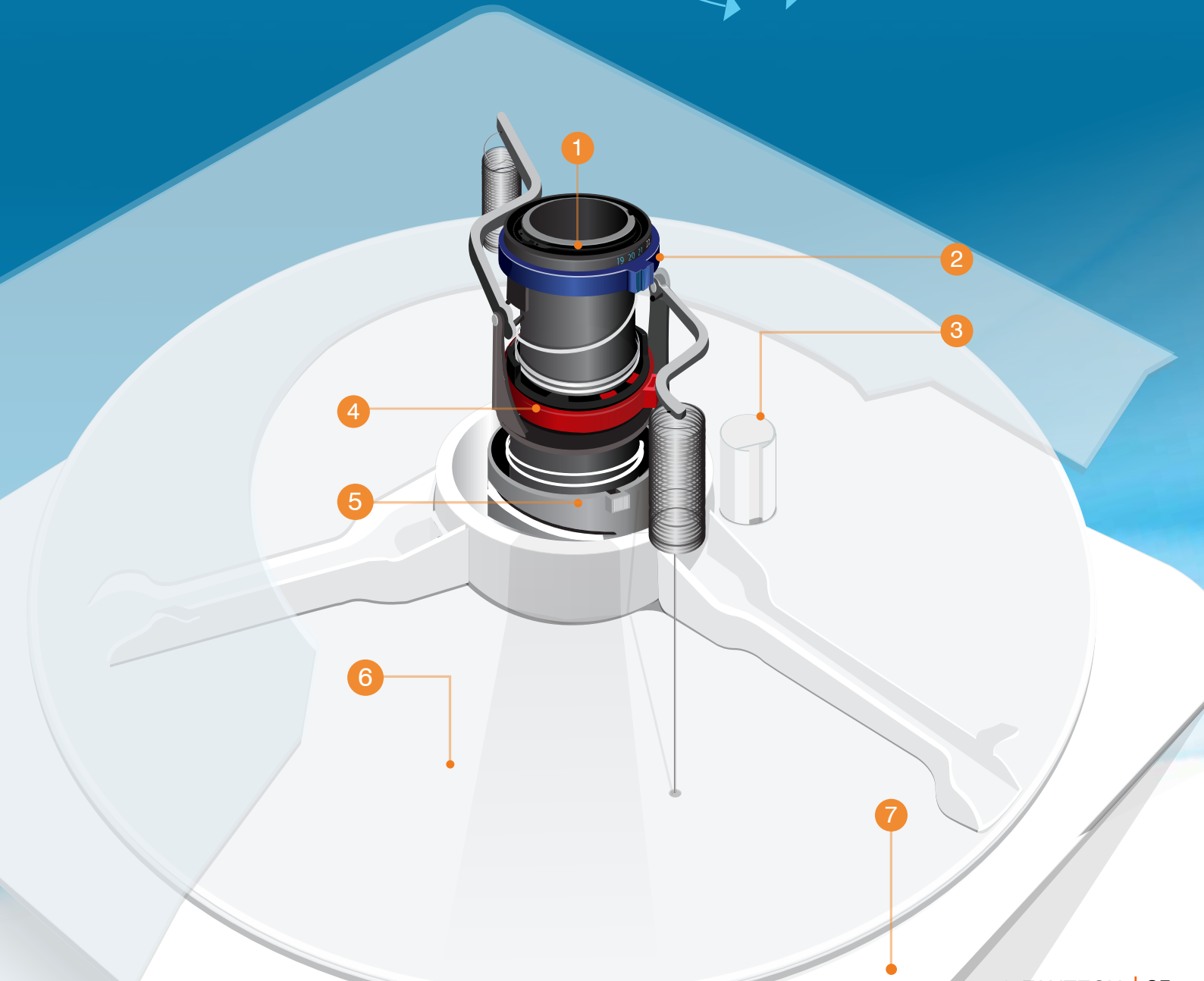
Reverse side view of Thermo-disc VAV diffuser



When aperture size increases, more conditioned air is allowed to enter the space



When aperture size decreases, less conditioned air is allowed to enter the space



Effective Duct Design

When designing a ventilation system, correct duct design is important. While duct design is a relatively simple task, it is probably the least understood aspect of a VAV installation.

A conventional high pressure ventilation system (pressure independent) appears to be tolerant of duct design deficiencies because there is usually substantially more pressure available throughout the system than required. High pressure ventilation systems can create the following issues:

- Excessive pressure usage
- Higher running costs
- Complex duct runs delivering inconsistent temperatures and air flows
- Cold air dumping and hot air stratification
- High noise levels

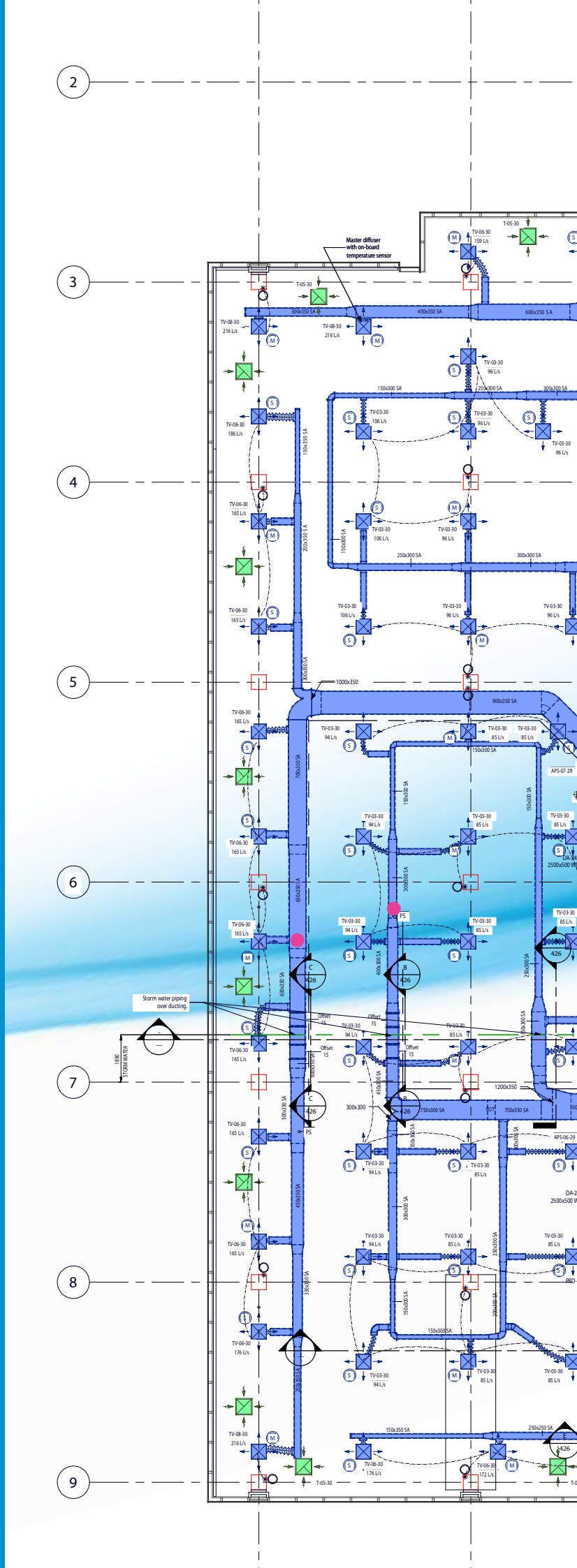
To overcome these issues an Even Pressure VAV system (pressure dependent) is preferred.

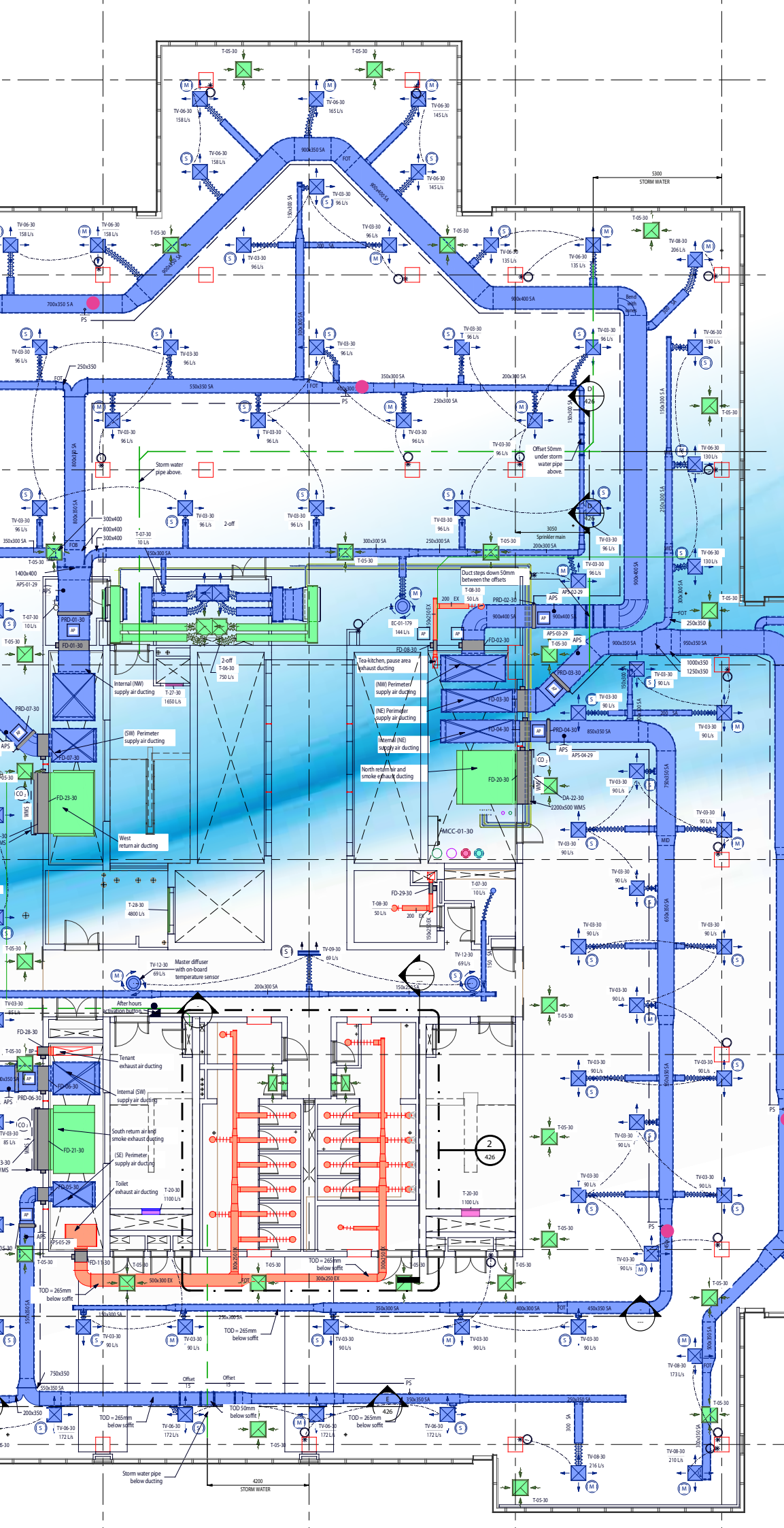
Rickard VAV Diffusers are designed to operate at optimum efficiency within a low pressure duct design. When total pressure is maintained between 30Pa and 50Pa at the diffuser spigot, VAV diffusers offer individual room comfort control with optimum energy efficiency.

A well designed lower pressure VAV diffuser system is easier and more cost effective to install. Duct components such as plenum boxes and opposed blade dampers are typically not required. It also simplifies air flow tuning once the system is installed.

The example here shows how an even pressure, pressure dependant VAV Rickard diffuser system was used to simplify duct design around the perimeter and on the internal zones of the building.

Contact Fantech to assist you with your low pressure duct design. Low pressure duct design recommendations will be for a Rickard VAV diffuser system.



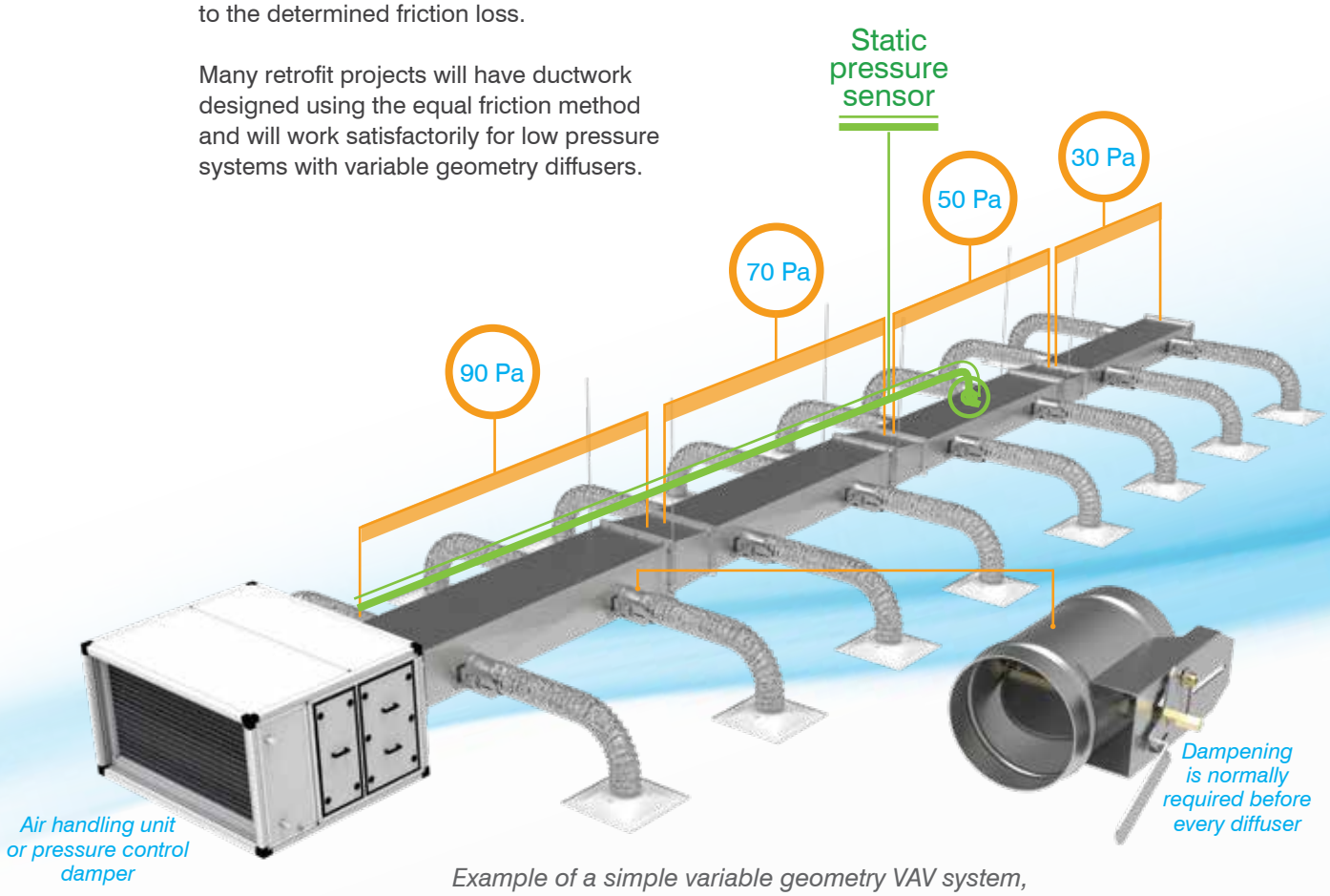

Key
Supply air ducting
Return air ducting
Exhaust air ducting
Duct air pressure sensor
Wall thermostat
Variable air volume diffuser master/slave symbol
Variable air volume diffuser master/slave connection to thermostat

Equal Friction Duct Design

Best Practice for Retrofits

Equal Friction Duct Design is based on the friction loss per unit of length being consistent with the complete system. Usually, the initial friction loss per unit of length is determined. Duct size for the ventilation system is then selected according to the air flow rate relative to the determined friction loss.

Many retrofit projects will have ductwork designed using the equal friction method and will work satisfactorily for low pressure systems with variable geometry diffusers.



Example of a simple variable geometry VAV system, using an Equal Friction duct design

Considerations

- Branch velocities should be between 4-6 m/sec.
- The duct run should be short enough so that the pressure drop from the beginning to the end falls within a 10% to 20% range to accommodate VAV Diffusers.
- Flexible duct runs of more than 1.5m can affect the operation of VAV Diffusers due to friction losses.
- An equal friction system can be tedious to balance. Dampening is normally required before each diffuser outlet.
- Zones to be downstream of the PCD to ensure correct temperature control.

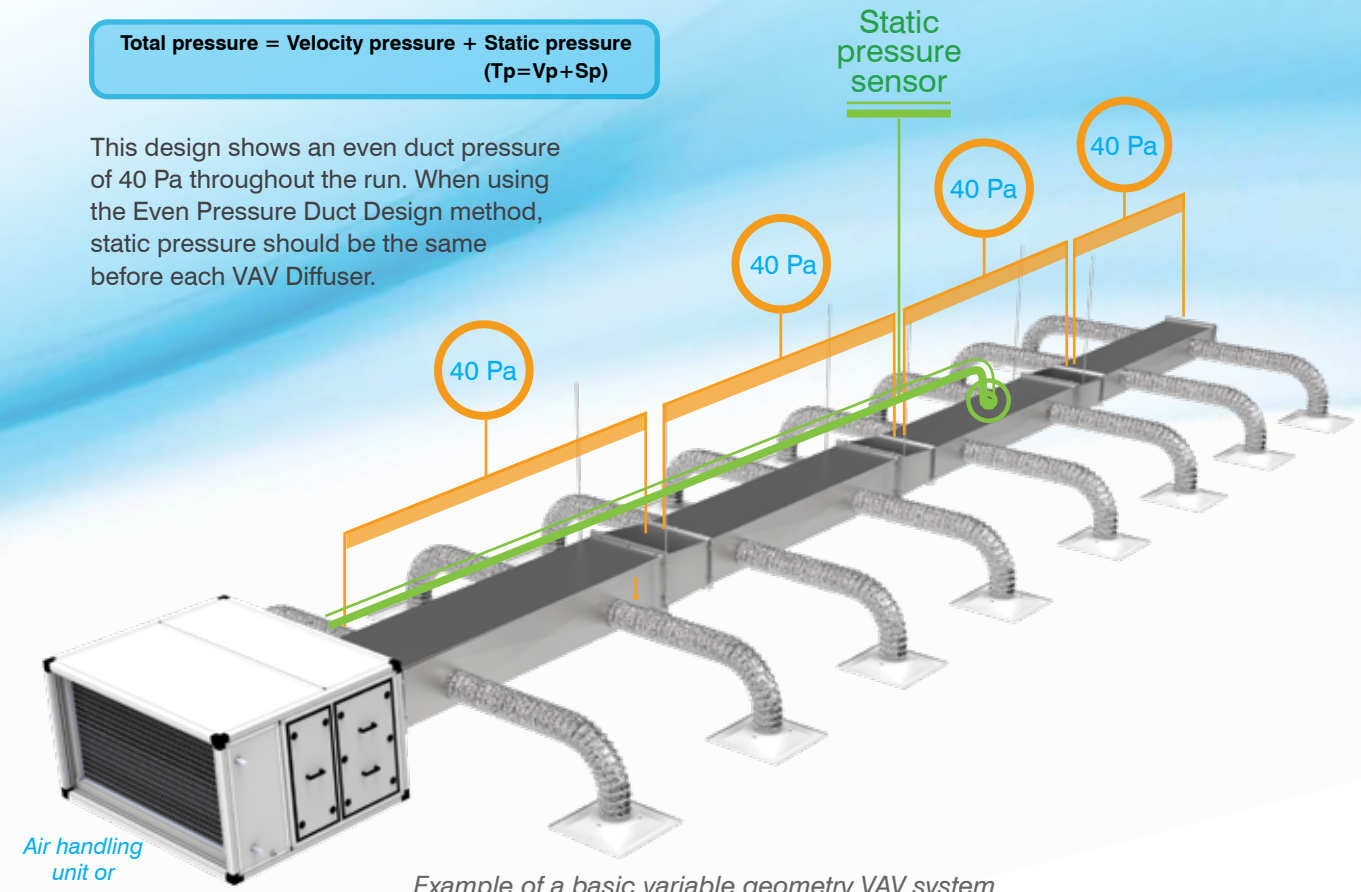
Even Pressure Duct Design

Best Practice for New Builds

The objective of an Even Pressure Duct Design is to have the same low static pressure throughout the complete duct run. The duct is sized so that the pressure loss in any section is equal to the pressure regain caused by reducing the velocity from the upstream section to the downstream section.

Total pressure = Velocity pressure + Static pressure
(Tp=Vp+Sp)

This design shows an even duct pressure of 40 Pa throughout the run. When using the Even Pressure Duct Design method, static pressure should be the same before each VAV Diffuser.



Example of a basic variable geometry VAV system, using an Even Pressure duct design

Considerations

- With the correct tools, designing an Even Pressure duct system is uncomplicated and straight forward. Contact Fantech to assist you with your design.
- Every Rickard VAV Diffuser has its own built-in motorised damper. Therefore there is no need to fit a separate balancing damper.
- Minimum and maximum air flows can be controlled electronically.
- When flexible duct is used, short duct lengths are recommended to reduce friction losses.

Flexibility of an Even Pressure Duct Design

A high performance VAV diffuser system works best when matched to an Even Pressure, Pressure Dependant Duct Design. However an adaptive method is commonly used to give HVAC designers the flexibility to work with familiar building parameters.

An Even Pressure Duct Design must have an even static pressure from the first diffuser take off. Any duct design method can be adopted for the main supply air duct.

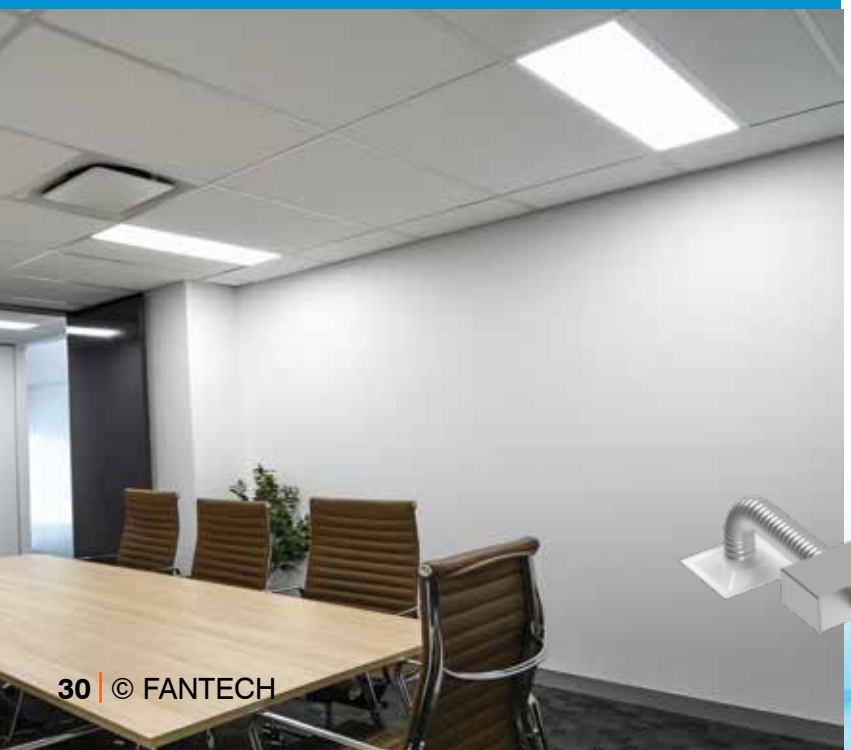
The pressure at each diffuser does not need to be perfectly even as the Rickard VAV diffuser can manage a ±10% tolerance with ease.

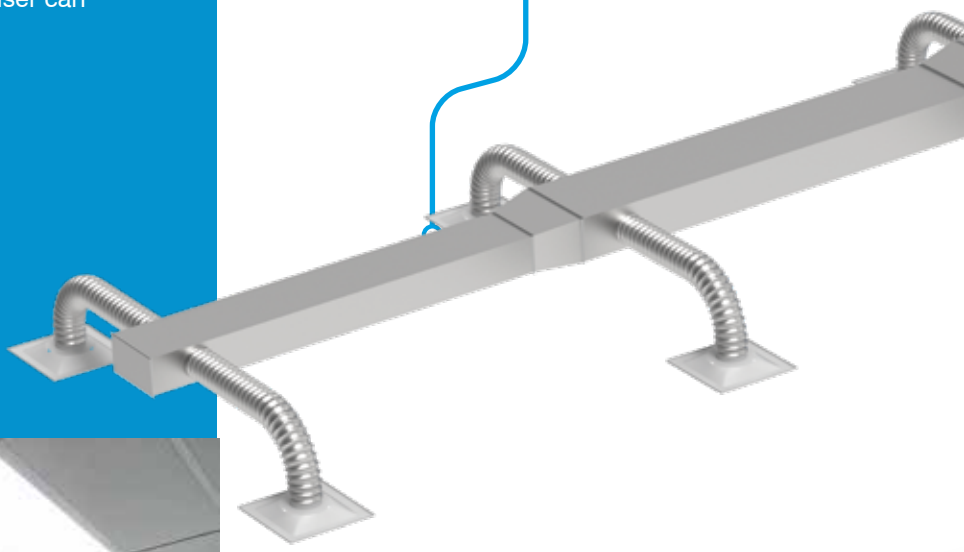
This duct design strategy is illustrated in the following diagram.

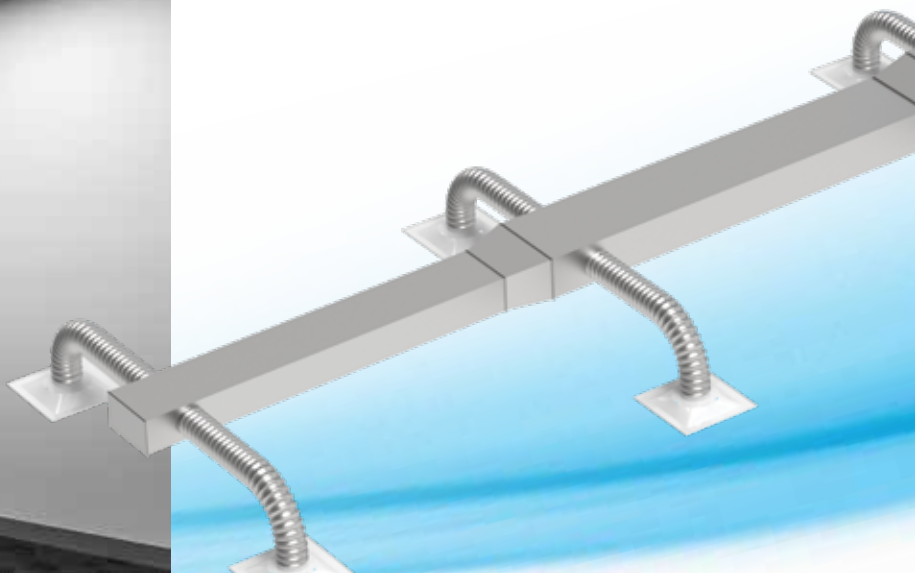
~150 Pa
- Fan discharge losses
- Sound attenuation
- Riser and ducting

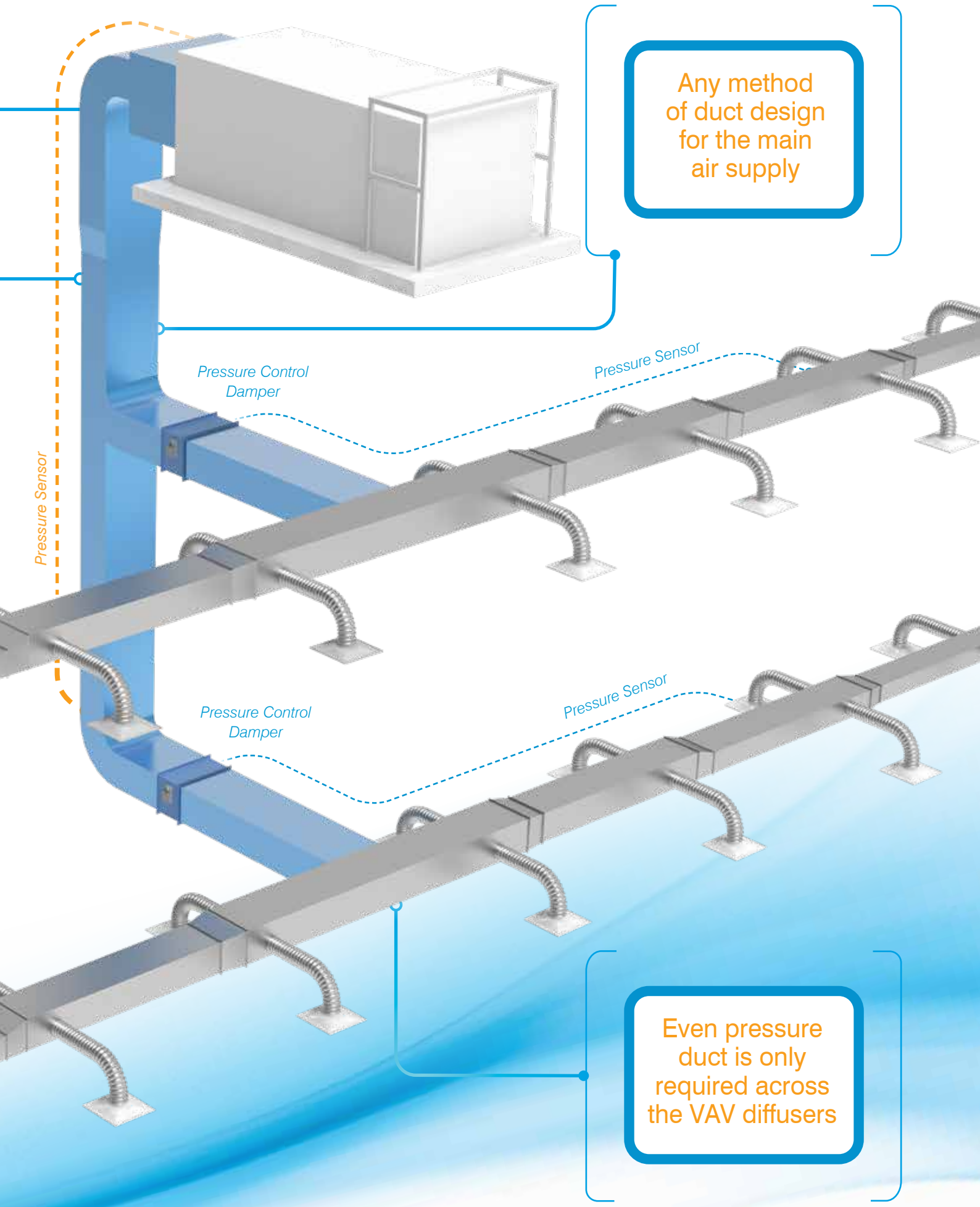
~100 Pa
- Riser take-off loss
- Fire damper
- Pressure control damper

Ducting designed to an even pressure
(Typically 30 Pa - 50 Pa)








Any method of duct design for the main air supply
Pressure Control Damper
Pressure Sensor
Pressure Sensor
Pressure Control Damper
Pressure Sensor
Even pressure duct is only required across the VAV diffusers

Rickard VAV Diffuser CFD Analysis

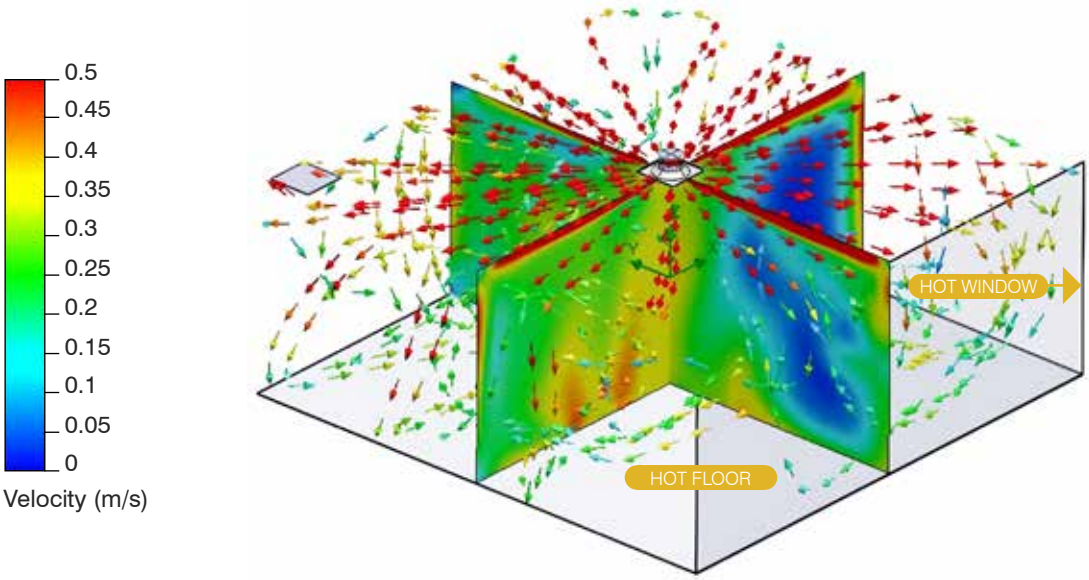
CFD Analysis

Optimised Throw and Exit Velocity

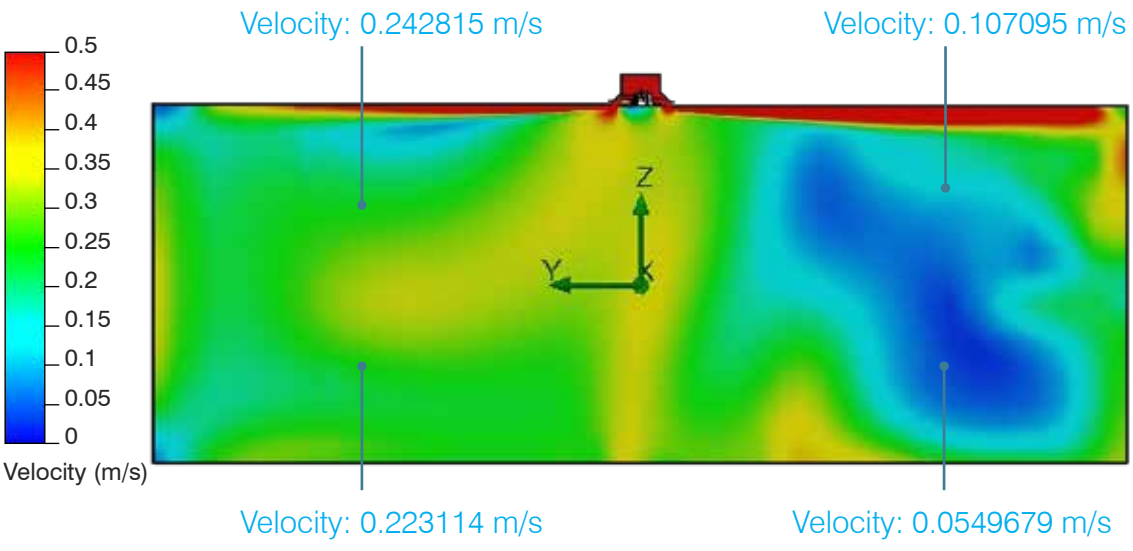
Rickard Variable Air Volume (VAV) diffusers are designed to maintain consistent airflow regardless of the airflow rate. This is accomplished by adjusting the diffuser's exit geometry to accommodate a lower airflow, which keeps the exit velocity steady and ensures consistent air distribution.

The term "throw" refers to the distance from the diffuser at which the air velocity drops below 0.25 m/s. If the air velocity is too high, it can cause drafts and negatively impact the Air Diffusion Performance Index (ADPI). Rickard VAV diffusers use a high-velocity air stream to maintain coanda and throw near the ceiling. It's important to select the correct diffuser for the space size and to meet load requirements.

Correctly selected Rickard diffusers support effective room air circulation while preventing drafts as demonstrated in the Computational Fluid Dynamics (CFD) analysis below.



Velocity Vector Plot: (VCD 300mm; Control Disc 30% open; Supply 12°C; Room 7m x 7m)



Velocity Vector Plot: (VCD 300mm; Control Disc 30% open; Supply 12°C; Room 7m x 7m)

CFD Analysis

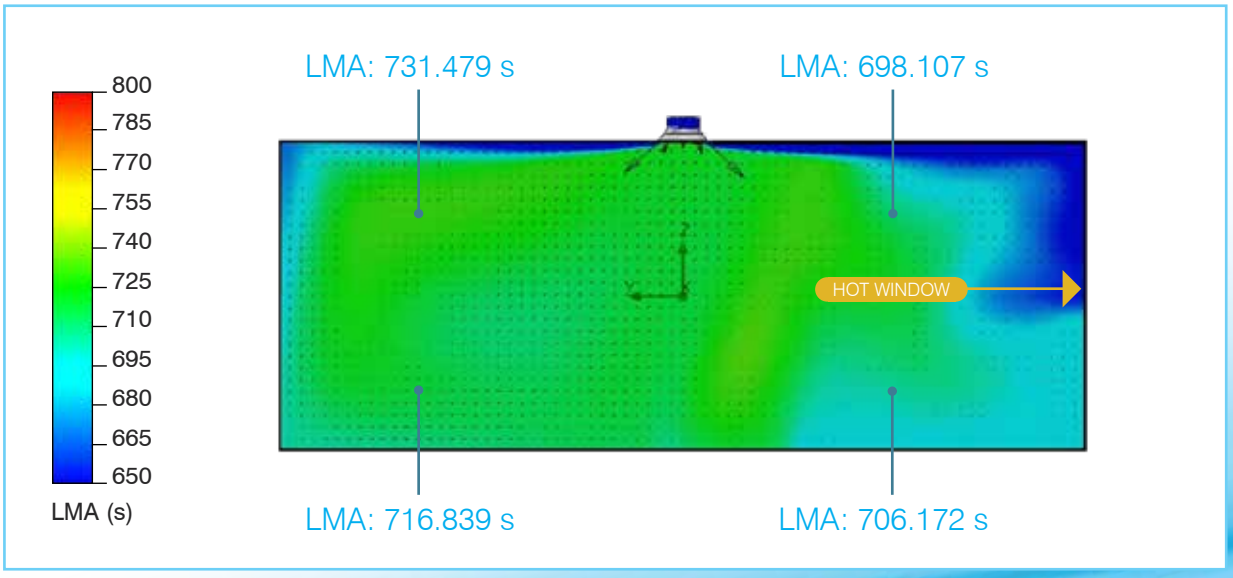
Enhancing Air Change Effectiveness

Air Change Effectiveness (ACE) is a measure of how effectively air is circulated in a room. It is calculated by dividing the age of air that would occur throughout the room if the air was perfectly mixed by the average age of the air that occupants would inhale.

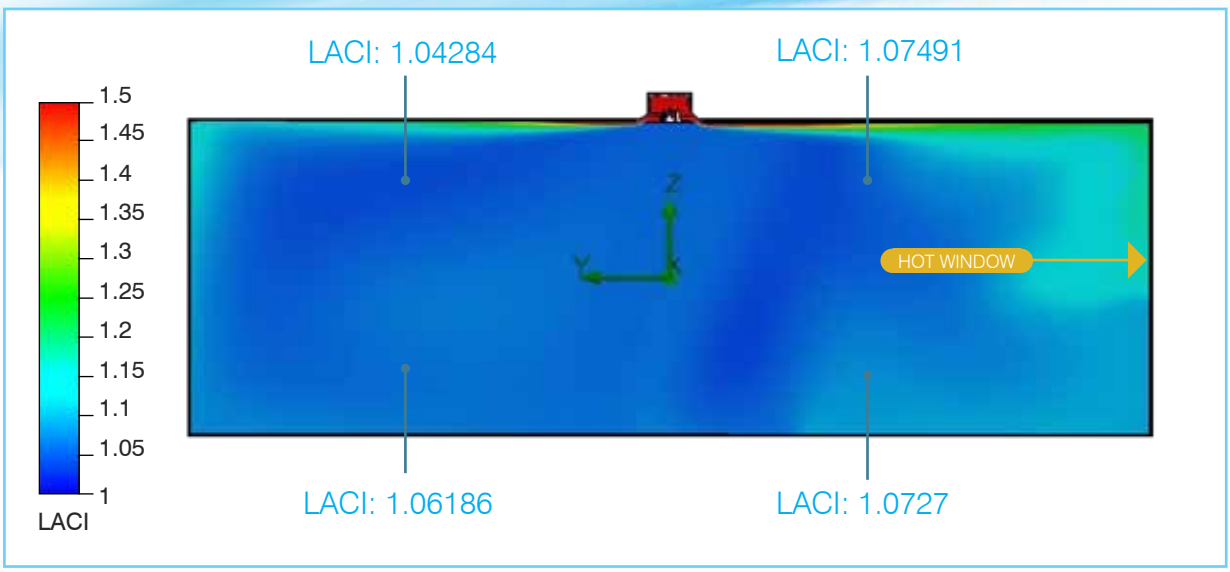
An ACE value of 1 indicates perfect uniform mixing in the room. If ACE is lower than 1, it means that the air is not circulating effectively between the supply air diffuser and the return air grill.
An ACE value higher than 1 can occur when the ventilation rate in the occupied space is higher than in the rest of the room due to air diffusion.

Low-pressure Rickard VAV diffusers can maintain adequate Air Change Effectiveness values even when operating at minimum supply air volumes.

The CFD clip below illustrates the Mean age of the Air throughout a typical room fitted with a Rickard Variable Geometry VAV diffuser.



Local Mean Age of Air: (VCD 300mm; Control disc 30% open; Supply 12°C; Room 7m x 7m)



Local Air Change Index: (VCD 300mm; Control Disc 30% open; Supply 12°C; Room 7m x 7m)
LACI close to 1 indicates acceptable room air mixing
LACI = LMA/time taken to fill room with air

CFD Analysis

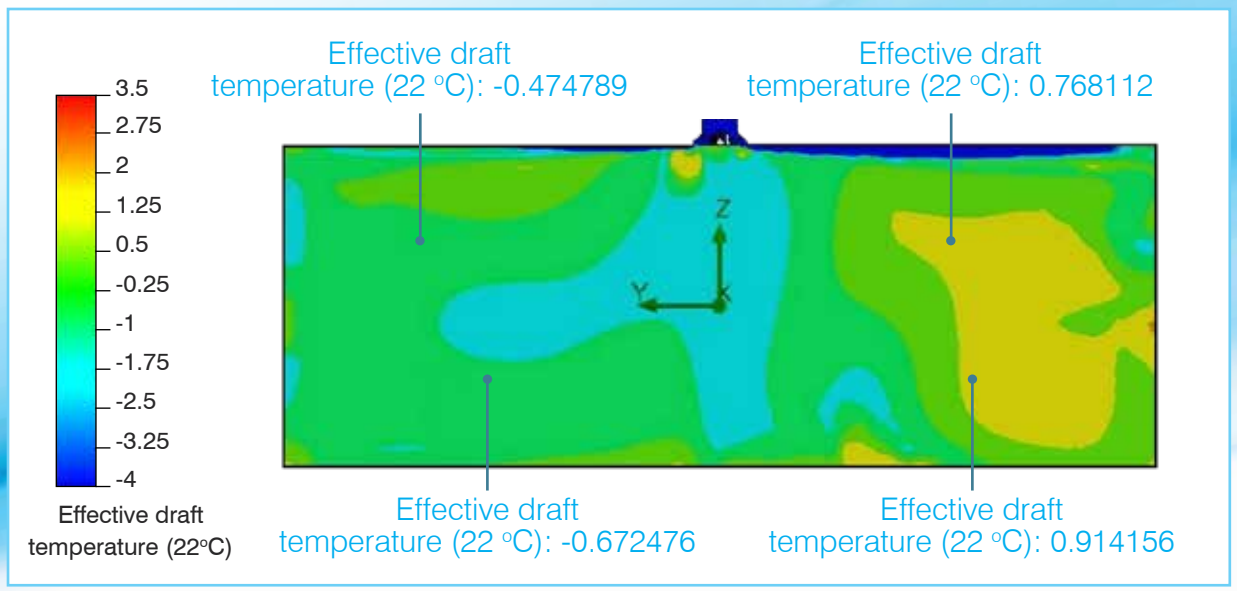
Optimised ADPI Performance

Air Diffusion Performance Index (ADPI) statistically relates the air temperature and air speed in occupied spaces to the thermal comfort of occupants. ADPI is calculated as the percentage of locations in the conditioned space that meet comfort standards.

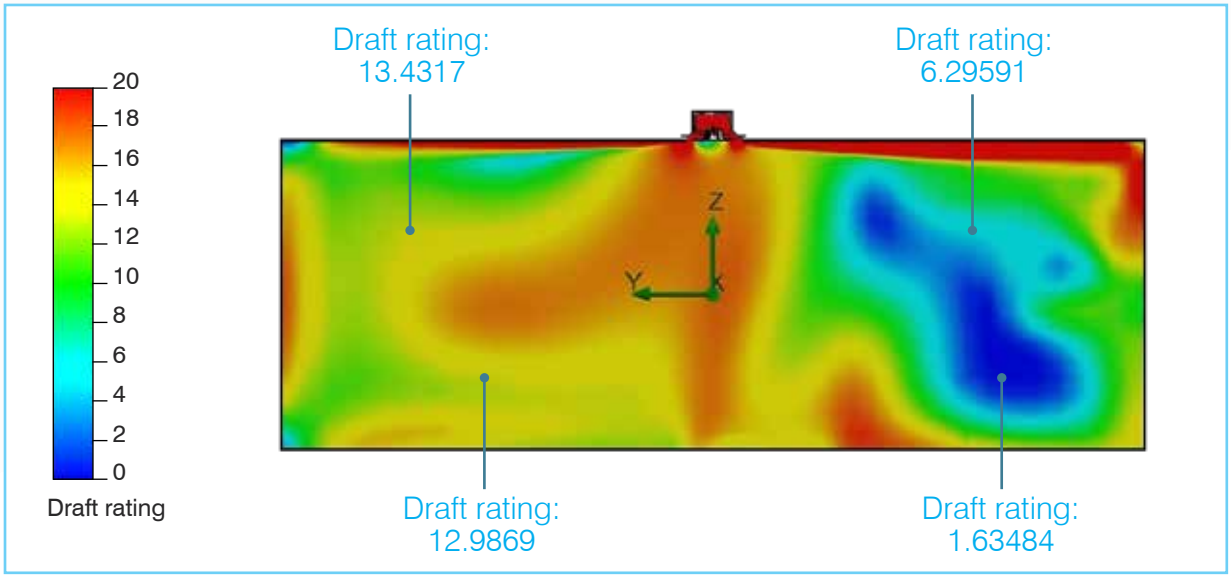
The "Ashrae Handbook: Fundamentals" indicates that conditions in the occupied space are acceptable when:

- The air velocity is below 0.35 m/s -
- The effective draft temperature is greater than -1.5 and less than 1. The effective draft temperature is calculated around the setpoint (Tc is 22°C in the plot below)
- The Draft Rating is less than 20. The Draft Rating represents the number of people that would be uncomfortable due to draft.

Correctly selected Rickard VAV diffusers that match the size of an occupied space and the load in the space will maintain optimum ADPI values throughout the range of control disc movement.



Effective Draft Temperature: (VCD 300mm; Control Disc 30% open; Supply 12°C; Room 7m x 7m)



Draft Rating: (VCD 300mm; Control Disc 30% open; Supply 12°C; Room 7m x 7m

Diffuser Specifications & Performance

Electronic Variable Disc Diffuser Range

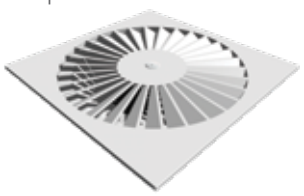
Square to Square Diffuser

Square to Round Diffuser

Round to Round Diffuser

Neck size (mm)	Style	Part Numbers			Neck Total Pressure (Pa)			
		Ø 580mm	□ 595mm		20	30	40	50
150	□	-	VSD1501S595-V2	Air flow (L/s)	62	76	88	98
	○	-	VCD1501S595-V2	Throw (m)	2	2.1	2.7	3
	◎	VRD1501S580-V2	-	NC Level (NC)	22	26	31	34
200	□	-	VSD2001S595-V2	Air flow (L/s)	108	131	151	169
	○	-	VCD2001S595-V2	Throw (m)	2	2.6	3	3.2
	◎	VRD2001S580-V2	-	NC Level (NC)	23	27	28	29
250	□	-	VSD2501S595-V2	Air flow (L/s)	145	176	201	226
	○	-	VCD2501S595-V2	Throw (m)	2.4	2.6	3.2	3.5
	◎	VRD2501S580-V2	-	NC Level (NC)	25	27	29	31
300	□	-	VSD3001S595-V2	Air flow (L/s)	176	211	245	275
	○	-	VCD3001S595-V2	Throw (m)	2.5	2.8	3.3	3.7
	◎	VRD3001S580-V2	-	NC Level (NC)	27	28	30	32
350	□	-	VSD3501S595-V2	Air flow (L/s)	242	298	345	389
	○	-	VCD3501S595-V2	Throw (m)	2.7	3.2	3.6	4.1
	◎	VRD3501S580-V2	-	NC Level (NC)	27	28	30	32

Square to Swirl Diffuser



Round to Swirl Diffuser

Neck size (mm)	Style	Part Numbers			Neck Total Pressure (Pa)		
		Ø 580mm	□ 595mm		30	40	50
150	⊛	-	VSW1501S595-V2	Air flow (L/s)	68	79	88
	⊛	VRW1501S580-V2	-	Throw (m)	1.8	2.1	2.3
				NC Level (NC)	27	29	31
200	⊛	-	VSW2001S595-V2	Air flow (L/s)	112	130	145
	⊛	VRW2001S580-V2	-	Throw (m)	2.2	2.5	2.8
				NC Level (NC)	28	31	33
250	⊛	-	VSW2501S595-V2	Air flow (L/s)	159	183	205
	⊛	VRW2501S580-V2	-	Throw (m)	2.9	3.3	3.7
				NC Level (NC)	29	33	35
300	⊛	-	VSW3001S595-V2	Air flow (L/s)	194	224	250
	⊛	VRW3001S580-V2	-	Throw (m)	2.9	3.3	3.7
				NC Level (NC)	30	33	36

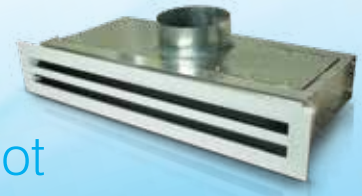
Throw data is taken 25mm below the ceiling on a line through the centre of the diffuser with the control disc fully open and air velocity at 0.25m/s.

Noise criteria levels apply to a single diffuser mounted in a room having a Sound Absorption of 10dB in octave bands having centre frequencies from 125Hz to 8000Hz (ie. the difference between Sound Pressure Level (dB re: 10^{-6} Pa) and Sound Pressure Level (dB re: 10^{-12} Pa) is equal to 10dB. These levels represent only the noise generated by the diffuser and do not take into account any duct-borne noise.

Diffusers are factory set for a minimum of 30% of the maximum flow levels reflected above. It should be noted that minimum air flow settings are approximate & may require to be reset on site to compensate for actual site system pressures.

Electronic Variable Linear Diffuser - 1 Slot

Neck size (mm)	Width size (mm)	Part Numbers		Neck Total Pressure (Pa)		
				30	40	50
150	600	VLN6001/1-V2	Air flow (L/s)	18	22	26
			Throw (m)	5.34	6.21	7.82
			NC Level (NC)	30	33	35
200	900	VLN9001/1-V2	Air flow (L/s)	30	37	43
			Throw (m)	5.21	6.84	8.37
			NC Level (NC)	32	35	37
250	1200	VLN12001/1-V2	Air flow (L/s)	44	54	63
			Throw (m)	4.58	5.45	6.02
			NC Level (NC)	33	36	38
300	1500	VLN15001/1-V2	Air flow (L/s)	53	65	75
			Throw (m)	4.77	5.61	6.16
			NC Level (NC)	34	37	39



Electronic Variable Linear Diffuser - 2 Slot

Neck size (mm)	Width size (mm)	Part Numbers		Neck Total Pressure (Pa)			Neck Total Pressure (Pa)			Neck Total Pressure (Pa)		
				30	40	50	30	40	50	30	40	50
150	600	VLN6001/2-V2	Air flow (L/s)	41	48	53	54	62	69	41	48	53
			Throw (m)	4.5	4.8	5.1	3.2	3.4	3.6	6.4	6.9	7.3
			NC Level (NC)	30	33	35	30	33	35	30	33	35
200	900	VLN9001/2-V2	Air flow (L/s)	71	82	92	85	98	109	71	82	92
			Throw (m)	5.5	5.9	6.3	3.9	4.2	4.4	7.8	8.4	8.9
			NC Level (NC)	32	35	37	32	35	37	32	35	37
250	1200	VLN12001/2-V2	Air flow (L/s)	96	111	124	118	137	153	96	111	124
			Throw (m)	6.4	6.9	7.3	4.5	4.8	5.1	9	9.7	10.3
			NC Level (NC)	33	36	38	33	36	38	33	36	38
300	1500	VLN15001/2-V2	Air flow (L/s)	118	136	151	155	179	199	118	136	151
			Throw (m)	7.1	7.7	8.1	5	5.4	5.7	10	10.8	11.5
			NC Level (NC)	34	37	39	34	37	39	34	37	39

3 & 4 Slot Electronic Variable Linear Diffusers also available

Electronic Variable Wall/Bulkhead Diffuser

Width size (mm)	Part Numbers (100mm, high)		Neck Total Pressure (Pa)			
			20	30	40	50
300	WBD3001/100-V2	Air flow (L/s)	58	75	90	95
		Throw (m)	5.2	6.4	7.2	8.3
		NC Level (NC)	28	32	36	38
350	WBD3501/100-V2	Air flow (L/s)	80	102	113	122
		Throw (m)	7.2	8.2	9.5	10.1
		NC Level (NC)	29	33	37	39
400	WBD4001/100-V2	Air flow (L/s)	100	130	149	155
		Throw (m)	7.8	8.6	10	11
		NC Level (NC)	29	33	36	38
450	WBD4501/100-V2	Air flow (L/s)	105	140	153	160
		Throw (m)	7	8.4	9.1	10.7
		NC Level (NC)	29	33	37	39
500	WBD5001/100-V2	Air flow (L/s)	110	144	162	170
		Throw (m)	8.4	9.4	10	11
		NC Level (NC)	29	34	37	39
550	WBD5501/100-V2	Air flow (L/s)	120	156	185	200
		Throw (m)	8.2	9.5	10.6	11.7
		NC Level (NC)	30	34	38	40
600	WBD6001/100-V2	Air flow (L/s)	135	178	205	229
		Throw (m)	8.6	10	11	13
		NC Level (NC)	30	34	38	40
650	WBD6501/100-V2	Air flow (L/s)	160	215	252	275
		Throw (m)	8.8	10.3	11.7	13
		NC Level (NC)	30	33	38	41

Width size (mm)	Part Numbers (150mm, high)		Neck Total Pressure (Pa)			
			20	30	40	50
500	WBD5001/150-V2	Air flow (L/s)	165	219	258	292
		Throw (m)	8.7	10	11	13
		NC Level (NC)	30	35	39	41
550	WBD5501/150-V2	Air flow (L/s)	190	250	288	302
		Throw (m)	8.8	10.5	11.2	12.8
		NC Level (NC)	30	34	38	41
600	WBD6001/150-V2	Air flow (L/s)	215	263	304	340
		Throw (m)	9.2	12	13	16
		NC Level (NC)	31	35	38	41
650	WBD6501/150-V2	Air flow (L/s)	230	300	350	370
		Throw (m)	9.4	10.3	13	15
		NC Level (NC)	32	35	39	42
700	WBD7001/150-V2	Air flow (L/s)	267	329	378	410
		Throw (m)	9.7	11	14	15
		NC Level (NC)	32	35	39	42
800	WBD8001/150-V2	Air flow (L/s)	305	373	431	482
		Throw (m)	10	11	15	16
		NC Level (NC)	32	35	39	42

Inline Duct Heaters

Wall Thermostats	
Part Numbers	**Description**
RICK-CU-INLH150	Inline heater ø150mm, 750W
RICK-CU-INLH200	Inline heater ø200mm, 1250W
RICK-CU-INLH250	Inline heater ø250mm, 1500W
RICK-CU-INLH300	Inline heater ø300mm, 2000W
RICK-CU-INLH350	Inline heater ø350mm, 2500W

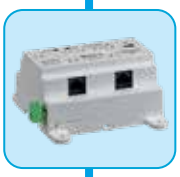
Electronic Control Range

Wall Thermostats	
Part Numbers	**Description**
RICK-MLMWS2	Wall thermostat
RICK-MLMOCWS2	Wall thermostat, c/w occupancy sensing
RICK-MLMWS-CO2	Wall thermostat, c/w CO_2 sensing

Pressure Relief Collar	
Part Numbers	**Neck size**
RICK-RELIEF200	Ø200mm Pressure releif collar
RICK-RELIEF250	Ø250mm Pressure releif collar
RICK-RELIEF300	Ø300mm Pressure releif collar
RICK-RELIEF350	Ø350mm Pressure releif collar

Wireless Controls	
Part Numbers	**Description**
RICK-WL-RXD	Wireless Access Point, connects up to 15 thermostats and sensors
RICK-WL-WS2	Wireless Wall Thermostat
RICK-WL-POD	Wireless Wall POD Temperature Sensor

Air flow Sensors	
Part Numbers	**Neck size**
RICK-SENS-AF150	Ø150mm Air flow sensor
RICK-SENS-AF200	Ø200mm Air flow sensor
RICK-SENS-AF250	Ø250mm Air flow sensor
RICK-SENS-AF300	Ø300mm Air flow sensor
RICK-SENS-AF350	Ø350mm Air flow sensor



Power Supply	
Part Numbers	**Description**
RICK-MLMPS	Power supply unit

Commissioning Kit	
Part Numbers	**Description**
RICK-CU-USB	Commissioning Kit

Master Communication Module	
Part Numbers	**Description**
RICK-CU-BNIP	BACnet/IP BMS Interface
RICK-CU-BNTP	BACnet MS/TP BMS interface
RICK-CU-IPSU	BACnet/IP BMS Interface + PSU

Control Cables	
Part Numbers	**Description**
RICK-CA-SLA8	8m Control harness
RICK-CA-SLA25	25m Control harness
RICK-CA-SLA35	35m Control harness
RICK-CA-EXT8	8m Control harness extender
RICK-CA-WS	8m cable with dust covers
RICK-CA-WS12	12m cable with dust covers
RICK-CA-CU003	300mm PSU to MCU power cable
RICK-CA-CU01	1m PSU to MCU comms cable
RICK-CA-CU20	20m PSU to MCU comms cable
RICK-CA-CU40	40m PSU to MCU comms cable
RICK-CA-CU80	80m PSU to MCU comms cable

Thermal Variable Disc Diffuser Range

Square to Square Diffuser

Square to Round Diffuser

Neck size (mm)	Style	Part Number 595mm x 595mm		Neck Total Pressure (Pa) 20	30	40	50
150	□	VSD1504S595	Air flow (L/s)	62	76	88	98
			Throw (m)	2	2.1	2.7	3
	○	VCD1504S595	NC Level (NC)	22	26	31	34
200	□	VSD2004S595	Air flow (L/s)	108	131	151	169
			Throw (m)	2	2.6	3	3.2
	○	VCD2004S595	NC Level (NC)	23	27	28	29
250	□	VSD2504S595	Air flow (L/s)	145	176	201	226
			Throw (m)	2.4	2.6	3.2	3.5
	○	VCD2504S595	NC Level (NC)	25	27	29	31
300	□	VSD3004S595	Air flow (L/s)	176	211	245	275
			Throw (m)	2.5	2.8	3.3	3.7
	○	VCD3004S595	NC Level (NC)	27	28	30	32

FANTECH
Intelligent Ventilation

Fantech Pty. Ltd.
Australia

Adelaide	(08) 8294 0530
Brisbane	(07) 3299 9888
Canberra	(02) 6280 5511
Darwin	(08) 8947 0447
Hobart	(03) 6273 6455
Melbourne H.O.	(03) 9554 7845
Perth	(08) 9209 4999
Sydney	(02) 8811 0400
Townsville	(07) 4775 5222

New Zealand

Auckland H.O.	(09) 444 6266
Christchurch	(03) 379 8622
Wellington	(04) 566 0532

Visit our website at **www.fantech.com.au**

Follow us on

Scan the QR code for more informations on Rickard products

FAN0103 09/24