

2

THE RICKARD VAV SYSTEM

APPLICATIONS

VAV COOLING & HEATING

VAV COOLING WITH TERMINAL REHEAT

ADVANTAGES

ENERGY SAVINGS

INSTALLATION COST SAVINGS

SIMPLE SYSTEM DESIGN

SELF BALANCING

FULL FLEXIBLTY

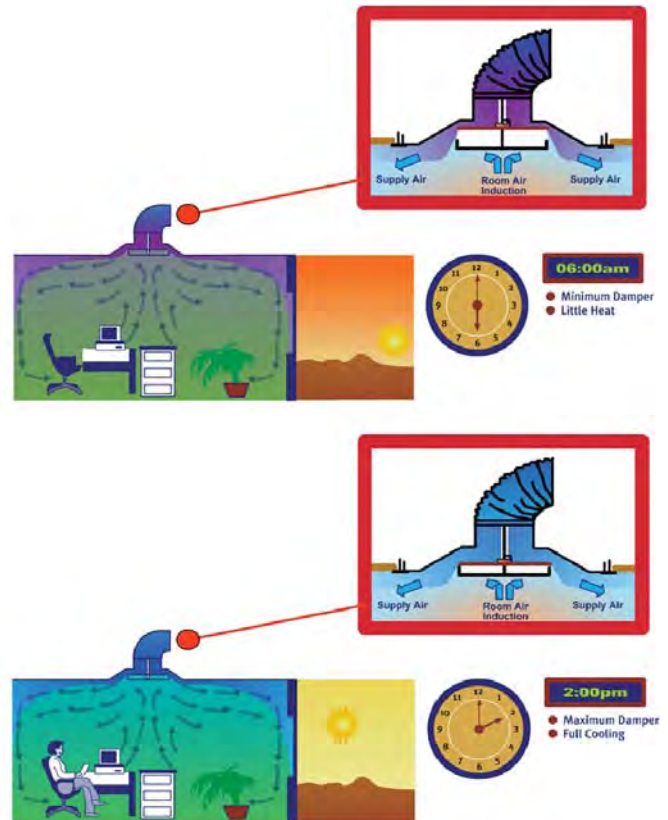
SUITS SMALL & LARGE BUILDINGS

NO REGULAR MAINTENANCE

EXCELLENT TURNDOWN RATIOS

LOW PRESSURE OPERATION

VARIABLE GEOMETRY VAV SYSTEMS



INTRODUCTION

WHY VARIABLE AIR VOLUME

With the introduction of **VAV** systems into the air conditioning industry a number of years ago, the idea of varying supply air volumes (at constant temperature) with room load variations, seemed to many engineers totally unacceptable. It went against all other contentions that reducing air volumes would result in insufficient room air. And then? The introduction of **VARIABLE GEOMETRY VAV AIR DIFFUSION EQUIPMENT!**

With the introduction of this equipment & design improvement to VAV systems, confidence was generated by the improved performance of the system. The world's increasing consciousness for the need to conserve energy accelerated the tendency of designers to use VAV as the most economical & efficient solution to the problems posed by the multi-zone requirements of modern buildings. Unquestionably no other system offers such low operating costs & flexibility in its application to multi-zone air conditioning diversities

ADVANTAGES OF VAV SYSTEMS

Fan power savings are achieved under low load conditions, whether system volume reduction is carried out by means of vortex dampers, speed control or axial flow fan blade pitch control.

Large central air handling plants facilitate easy **free outside air cooling**.

Savings on initial costs can be effected in air handling/refrigeration plant & duct sizing by designing with cooling load diversities.

Separate air handling unit zone installations are not usually necessary because individual terminal control action takes care of the variations in volume & temperature requirements in every office or room. As a result, initial cost savings are made in air handling units, ducting & associated equipment.

Simple system design results in ease of operation, maintenance & system adjustment.

VAV Systems are virtually **self balancing**, thereby almost completely eliminating the costly time consuming air quantity procedures.

Through simple control changes, **FLEXIBILITY**, to suit partition changes is one of the major advantages of the system.

In small & medium size systems, direct expansion cooling or heat pump plants may be used, avoiding the greater cost & complications of water cooling & circulation equipment.

Maintenance & repair work is made easy as equipment is concentrated in central plant rooms.

TYPES OF VAV SYSTEMS

Reference to the following drawings show that VAV Systems can be divided into two main groups, namely:

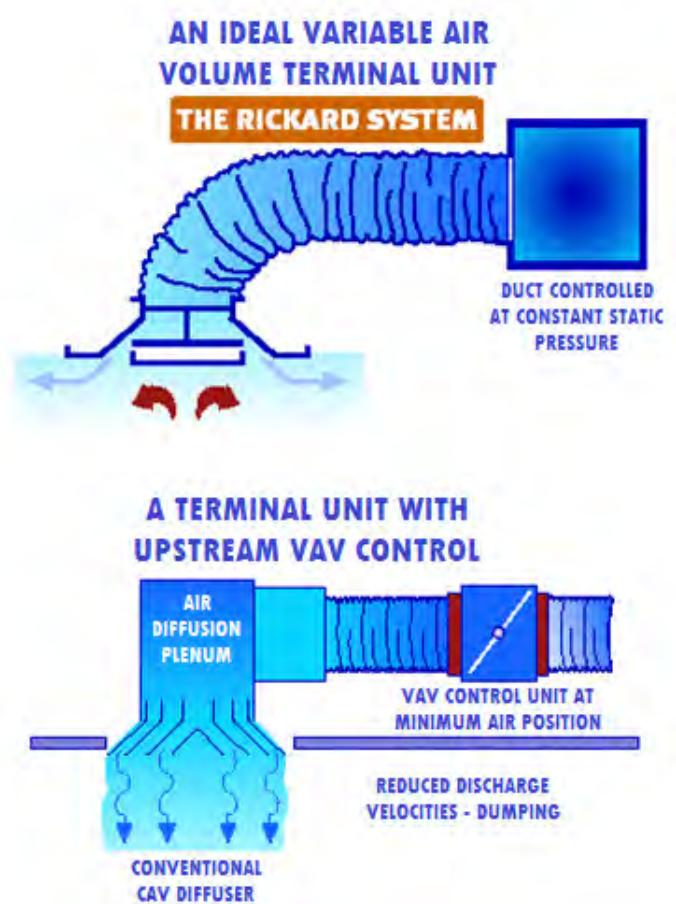
Those that control the volume of supply air at the point of entry into the room.

Those that control the volume of air further upstream in the system, such as in a VAV box.

The first group is by far the more effective & therefore the more generally desirable. Modern VARIABLE GEOMETRY room air entry device design, ensures good supply air distribution & effective room air movement when supplying down to as little as 30% of the maximum air flow without dumping or stratification.

The alternative VAV utilizes an air volume control device located a considerable distance upstream of the air diffusion unit & is therefore not able to take advantage of leaving air velocities to produce good secondary flows as in the case of the VARIABLE GEOMETRY type.

Under these circumstances, air volume regulation can cause cold air "dumping" & insufficient room air circulation. Systems such as these may be useful in internal zones or other applications which do not exhibit large load variations, such as shops with relatively constant internal heat gains.

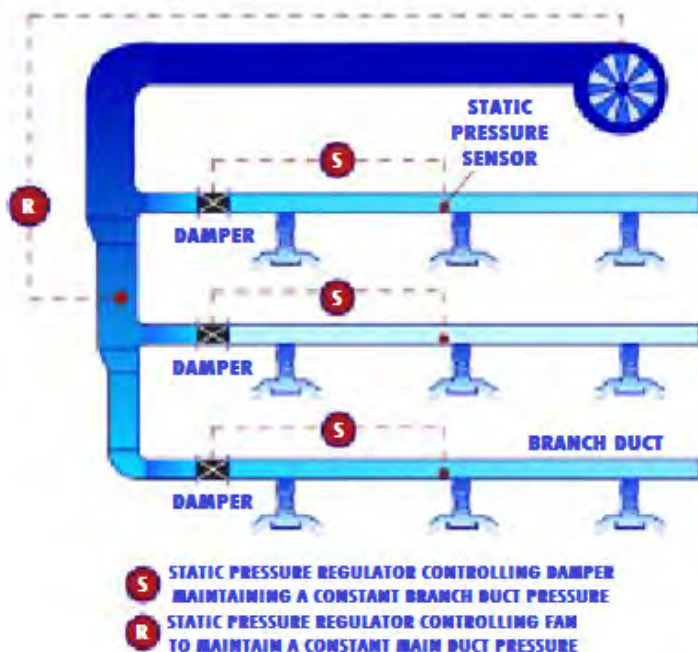


VAV SYSTEMS DESIGN

Generally the design considerations governing constant volume air conditioning systems can be applied to the design of air handling & distribution equipment for variable volume systems. Whilst the subjects of heat loads & air quantity or temperature calculations are fully dealt within such publications as the ASHRAE guide, the following general procedure is recommended:

1. Cooling & heating load calculations are made for every module or zone in the building so that the individual maximum & simultaneous maximum cooling/heating requirements & air quantities can be established.
2. The design temperature of supply air at the terminal (allowing for all normally calculated extraneous gains such as fan heat & duct wall heat pick-up) is arrived at by conventional psychometric calculations.
3. Individual maximum module or zone air volumes are calculated using the maximum room sensible heat gain figures & the temperature difference between supply air temperature at the terminal & design space temperature. These air volumes are then used to select the VAV diffusers.
4. Maximum simultaneous cooling & air supply requirements are then computed in order to establish the capacity of air handling units & central cooling plant. Care must be taken in design that ducting is adequately sized to convey the correct amount of air to every module or zone under all conditions.

A TYPICAL SYSTEM IN OPERATION WITH PRESSURE CONTROL DAMPERS



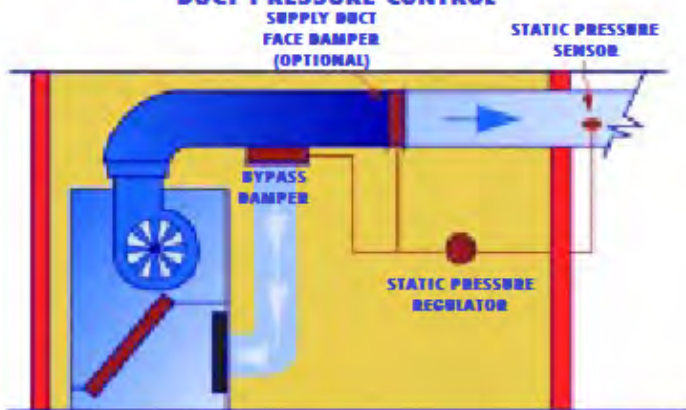
OTHER DESIGN CONSIDERATIONS TO BE NOTED

CONTROL OF DUCT PRESSURE

The control of supply air duct static pressure within the design limits of the terminal units is an essential requirement of variable volume systems & such control is easily achieved by any or a combination of the following methods, depending on the size & configuration of the air distribution system:

1. Control of supply air duct fan output by means of static pressure regulator operating in conjunction with its capacity modulation device. In smaller systems this device need be no more than a good vortex damper although acceptable performance will probably be achieved with face & by-pass damper configuration.
2. Dividing the air distribution system into the most conveniently selected low pressure supply duct zones, supplied with low/medium pressure main ducts or risers, by the fitting of branch duct dampers operating in conjunction with branch supply duct static pressure regulators.

AIR HANDLING UNIT SHOWING SUITABLE DUCT PRESSURE CONTROL



DUCT STATIC PRESSURE VARIATIONS

Design & manufacture discrepancies in supply duct systems are largely compensated for by terminal volume adjustment in response to thermostat action. Tolerances of -10% to +20% in duct static pressure will not materially effect correct functioning of variable volume terminal units. Under all terminal output conditions, duct pressure variations will be compensated for by temperature controllers which react to an incorrect supply of air by the terminal volume regulation. At minimum flow, variations in duct static pressure are normally slight as duct losses at low air flow are almost non-existent.

RECOMMENDED BRANCH DUCT PRESSURE

The determination of branch duct pressure should be governed by the noise levels to be satisfied, the area the conditioned air is to serve or throw & the duct pressure needed to deliver the flow required by load calculations. All these details are provided in the relevant sections of the RICKARD manual.

RECOMMENDED MAIN DUCT OR RISER PRESSURE

For economical fan operation, this pressure should be just high enough to accommodate main duct or riser pressure losses & design tolerances. With careful riser duct design it should not be necessary to require riser or main duct pressure to be more than 100Pa above branch duct static pressure.

POSITIONING OF STATIC PRESSURE SENSORS

In all cases static pressure sensors for branch ducts should be fitted in the branch ducts themselves & not in the feeder ducts to the individual terminals nor into the actual terminals. Generally it is recommended that static pressure sensors in branch ducts be fitted half or two thirds of the way between the duct pressure control damper or supply fan & the end of the relevant duct so that the most representative pressure is sensed.

BRANCH DUCT VELOCITIES

In the case of branch ducts serving terminal units, it is recommended that conventional criteria be used in the determination of branch duct velocities, & assuming that, depending on noise level requirements, these will typically be in the range of 3.5 to 6m/s.

In some cases slightly higher branch duct velocities are allowed because of the inherent noise attenuation properties of the terminal units & associated flexible duct connections. Generally a maximum of 7.5m/s is recommended. In smaller air handling units of the fan-coil type incorporating light duty centrifugal fans, volume regulation is most easily achieved by fitting supply air duct restrictors & by-pass dampers. This system is also used when packaged air handling equipment is to be specified.

Cooling plants of the direct expansion type, generally cheaper to install & operate than chilled water generating plants, can be used for virtually every application. Limitations of this type of plant are imposed only by capacity. In the case of smaller plants where cooling is controlled in only one or two steps, the temperature sensor for cooling control should be placed in the "warmest" room.

This avoids short cycling of compressors, which would result if the off coil temperature were to be used for control.

HIGH VELOCITY SYSTEMS

Building space limitations may dictate the use of high velocity systems, obviously at an operating cost premium due to the resultant high fan operating pressures.

At the point of change from high velocity, pressure reducing dampers are required. Each damper unit may require a sound attenuator to reduce high velocity duct & damper noise generation through pressure reduction.

VARIABLE GEOMETRY TERMINAL UNIT DESIGN

Having discussed overall design, we now consider the advantages of the RICKARD VARIABLE GEOMETRY air diffusion concept. Essentially the concept utilizes the principal of varying the shape of the air diffusion device at the point of discharge into the air conditioned space. This ensures that constant air distribution patterns & room air induction rates are maintained from minimum to maximum flow conditions.

THE PRINCIPAL OF OPERATION VAV COOLING/REHEAT SYSTEMS

COOLING

During the cooling cycle each terminal unit, or group of terminal units, varies the volume of supply air at constant temperature to the air conditioned space in response to the output from a room or zone temperature controller. Generally the range of volume control is from 100% down to 30%.

The RICKARD range of VARIABLE GEOMETRY air diffusion equipment is so designed such that room air movement remains essentially constant even at minimum terminal air volumes. This is because lower volumes discharge at higher jet velocities.

REHEATING

Should the temperature in the room or zone fall below setpoint, thereby calling for supplementary heating, the terminal reheaters, when fitted, will be automatically energized. In this mode the heaters are only energized when the terminal unit is delivering minimum air so that energy consumption is kept as low as possible.

In a well designed system, when heating is required, the cold air supplied to the terminal unit is in fact obtained “free” by economy cycle damper operation thereby avoiding unnecessary reheating of previously cooled air.

VAV COOLING/VAV HEATING SYSTEM

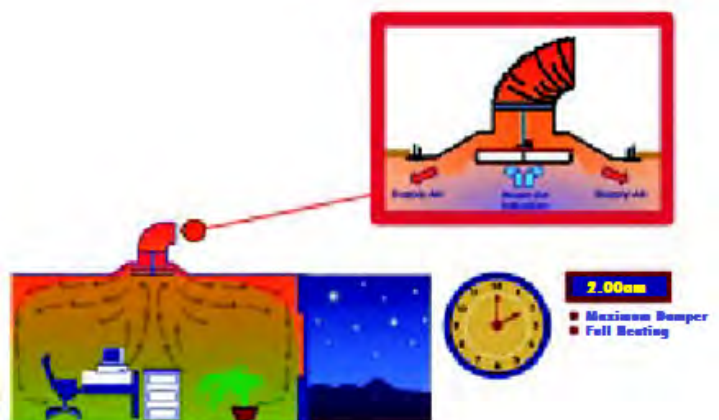
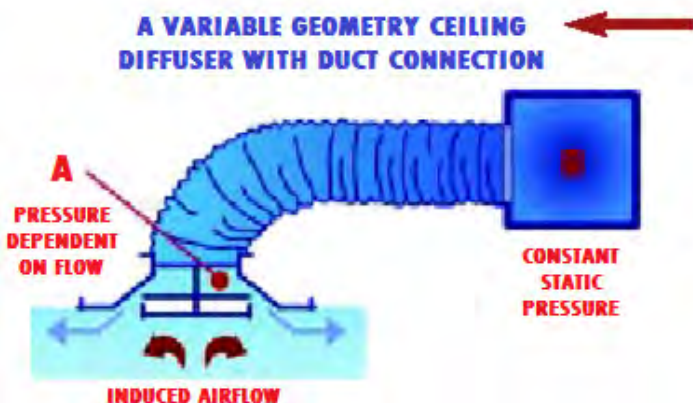
Through modern electronic technology, at low cost, the action of the conventionally controlled RICKARD VARIABLE GEOMETRY VAV terminal equipment may be reversed such that during the heating mode, a decrease in room temperature will cause an increased volume of pre-heated air to enter the air conditioned space. This is brought about electronic controller detecting that the supply temperature entering the VAV terminal is above room temperature. Therefore, through careful design & zoning considerations, the amount of reheat required could be substantially reduced without sacrificing flexibility or individual control.

THE PRINCIPAL OF AIR FLOW MODULATION OF VARIABLE GEOMETRY VAV TERMINALS

The adjacent diagram shows a supply air duct, a circular flexible connection & a RICKARD VARIABLE GEOMETRY VAV terminal. The terminal unit has a variable geometry air volume control device activated in response to room temperature conditions.

The static pressure in duct “B” is controlled at a constant level as the VARIABLE GEOMETRY control device varies the aperture of the terminal unit to modulate the flow of air. As the air volume flowing from “B” to “A” is decreased, the resultant static pressure in “A” is increased. Therefore, the increased static pressure at lower flow rates is converted to velocity pressure resulting in increased air velocity entering the air conditioned room.

Although mass flow at minimum supply air status is considerably reduced, the increased air velocity ensures good induction rate and hence excellent room air movement.



THE PRINCIPLE OF AIR FLOW MODULATION OF VARIABLE GEOMETRY TERMINALS

The RICKARD range of low pressure VAV air distribution equipment incorporating the VARIABLE GEOMETRY concept is available in several types which are VCD, VSD, VLN & WBD.

VARI-DISC VARIABLE GEOMETRY VAV CEILING DIFFUSER FEATURE LIST

GREEN BUILDING BENEFITS	<ul style="list-style-type: none"> • Management Credits • Indoor Environmental Quality Credits • Energy Efficiency Credits
MAINTAIN EXIT VELOCITY	<ul style="list-style-type: none"> • Volume adjustments are made by changing the exit Geometry therefore maintaining the exit energy
MAINTAIN THROW	<ul style="list-style-type: none"> • Throw is a function of volume and velocity • At reduced air volume velocity is increased • Throw at min flow is maintained
MAINTAIN COANDA	<ul style="list-style-type: none"> • Exit velocity increases at Minimum Air • Coanda effect relies on velocity • No dumping of cold air
AIR CHANGE EFFECTIVENESS	<ul style="list-style-type: none"> • Effective Ventilation • Excellent Room Air Circulation • Effective Mixing of Air
EXCELLENT ADPI VALUES	<ul style="list-style-type: none"> • Velocity and Temperature levels in 80% of the room are within the Ashrae recommended comfort range
ON-BOARD SENSING	<ul style="list-style-type: none"> • Effective Room Induction • Forced induction onto sensor • Good Representation of room conditions
USER FRIENDLY DESIGN	<ul style="list-style-type: none"> • Component Access from below the ceiling • Master/Slave changes can be done below the ceiling
EASE OF INSTALLATION	<ul style="list-style-type: none"> • Light Diffuser • Tile can be installed separately • Fits various ceiling styles
RELIABILITY	<ul style="list-style-type: none"> • Diffuser has passed life cycle testing the equivalent of 30 years. Basis: 3000 operating hours and 4000 control cycles per year
INTELLIGENT CONTROLS	<ul style="list-style-type: none"> • Cost effective standalone BMS • LonWorks compatible BMS • BACnet compatible BMS

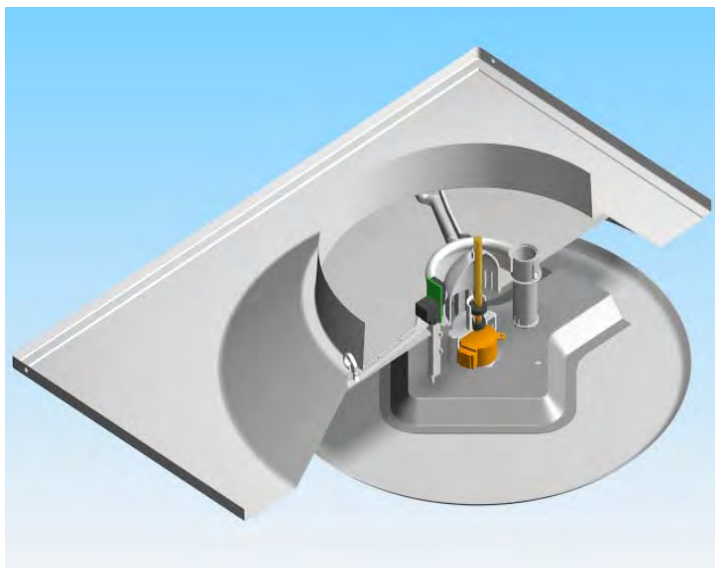


VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

DIFFUSER DESIGN AND CONFIGURATION

- The Rickard Variable Geometry VAV diffuser has been designed to provide a Cost Effective, Architecturally Pleasing, Aerodynamic & Functionally Superior Variable Volume Diffuser.
- Three point Bayonet type clip-in support of Trim Plate, Control disc & Lindrive2® actuator.
- Merely twist the Trim Plate 5° clockwise, unplug the Lindrive2® cable & remove all moving parts from below the ceiling. No skilled labour or specialised tooling required.
- Bayonet support means no support posts visible from within the air-conditioned space.
- Stainless steel safety cable incorporated to ensure that internal components do not fall in the event of a building fire.
- All control & power cabling concealed within the bayonet fitting and venturi tube.
- Superior aerodynamically shaped components reduce noise & improve air flow characteristics.
- Pressed diffuser edge detail ensures the face of the diffuser is flush with the ceiling tee face.
- New Lindrive2® actuator makes for precise control disc positioning.
- Lindrive2® actuator enables electronically adjustable maximum & minimum control disc limits.
- Aerodynamically shaped Lindrive2® actuator enclosure reduces air friction & noise.
- Accurate onboard room temperature sensing is achieved by sampling air through a central port in the diffuser face by using venturi tube & induction channel technology
- No access into ceiling void required to remove all internal diffuser components—simply twist the trim plate clockwise, unplug control cabling from bayonet mounted socket & disconnect the safety cable.
- All internal components of none metallic construction are moulded in fire retardant Makrolon glass reinforced plastic – the same material used on the Rickard (UL Certified) Thermo-Disc actuator.
- New Lindrive2® actuator and Rickard controls power consumption is so low that 15 diffusers can be supplied by a Single Power Module. A maximum of 2VA is used per diffuser and only when the motor drives.



VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

GENERAL INFORMATION

The RICKARD VARIABLE GEOMETRY VARI-DISC CEILING DIFFUSER is designed for general building zones where uniform radial discharge is the most suitable & desirable supply air distribution pattern. The basic diffuser is available in a wide range of options to suit every individual requirement.

Optimum performance in terms of uniform air distribution & low noise levels have been combined with simple construction & aesthetically pleasing appearance to provide a unit which is both functional & reliable. All diffusers are of steel construction & are finished in a chip resistant baked epoxy coating which is available in a wide range of colours to suit architectural requirements.

OPERATION

GENERAL DISCRIPTION

Room temperature is controlled by varying the supply air volume in accordance with demand. Volume control is achieved by moving a disc, known as a control disc, vertically up & down within the diffuser so as to vary the aperture through which the air passes. This is effectively what constitutes the "VARIABLE GEOMETRY" concept which maintains acceptable air movement in the room throughout the range from 100% down to as little as 25%.

The position of the control disc is varied by means of an electric actuator which drives the control disc in response to a signal received from a temperature controller. When used in conjunction with one of the RICKARD controllers, the diffuser will control room temperature on a proportional/integral basis. Air is discharged in a horizontal 360° pattern. Used in conjunction with our MLM controls, maximum & minimum supply air volumes may be adjusted to suit the particular design conditions. For a detailed system design description, please refer to Section 1 of this catalogue.

MAINTENANCE

Although the diffusers require no routine preventative maintenance, all mechanical components as well as the actuator & controller are accessible from below the ceiling. As a result of the "MODULAR" design of the diffusers, changing components does not require highly skilled labour or special tools & can be carried out with minimal disruption to room occupants.

DIFFUSER SELECTION

GENERAL

The first consideration when designing a system is to calculate the required supply air volume & temperature to satisfy room conditions at maximum heat loads. It is recommended that ducting is sized using static regain design principles. Supply air velocities in branch ducts should be between 3.5 & 7.5m/s (650 & 1500ft/min).

THROW

This is the distance from the centre of the diffuser to the point

at which the supply air velocity has reduced to 0.25m/s (50ft/min) when measured 25mm (1 inch) below the ceiling & the control disc in the fully open position. Coning occurs when two airstreams traveling in opposite directions meet & result in a downward moving cone of air. A similar effect is experienced should a diffuser be positioned at a distance from the wall that is less than its throw. The air will strike the wall & flow in a downward direction such that the point at which the air reaches a velocity of 0.25m/s (50ft/min), the sum of the horizontal & vertical travel of the air is equal to the diffuser throw. Throw remains at acceptable levels throughout the range of air flows, a feature of the variable geometry VAV diffuser concept.

NOISE LEVEL REQUIREMENTS

The published diffuser noise level must be checked to ensure it is within the project specification. Published diffuser noise levels represent only the noise generated by the diffuser & do not take into consideration any duct-borne noise.

DUCT STATIC PRESSURE

Diffuser performance has been established using diffuser neck TOTAL pressure, although that which is normally known or measured is duct STATIC pressure. What happens between the duct & the diffuser depends on the length & type of flexible duct being used. For simplicity, it can be assumed that the duct STATIC pressure is approximately equal to the diffuser neck total pressure. This is a valid assumption for systems where flexible duct lengths are not excessive & can be explained briefly as follows:

The static pressure loss due to friction in the flexible duct ($\pm 10\text{Pa}$ or 0.04ins wg) would normally be about the same as the velocity pressure in the neck of the diffuser & since total pressure is the sum of static & velocity pressure, we can say that neck total pressure is numerically approximately the same as duct static pressure. Although the tables reflect diffuser performance for neck total pressures ranging from 20-100Pa (0.04-0.40ins wg), caution should be exercised when selecting diffusers outside the 40-80Pa (0.08-0.32ins wg). At lower pressures air movement & induction may be insufficient & at higher pressures draughts & excessive noise may result. Best results are obtained when diffusers are selected at pressures of 50-70Pa (0.20-0.28ins wg). Bear in mind that all diffusers served by a common duct will all operate at the same static pressure as controlled by the pressure control damper. Therefore diffusers which are able to supply more air than is necessary will be driven partially closed by the temperature controller & hence the system becomes self-balancing.

NOTE: Avoid upstream restrictions such as manually adjusted dampers or squashed flexible ducting. The reason being that at maximum flow any restriction will result in a significant static pressure loss (which for some cases may be desirable) whereas at minimum flow conditions offer virtually no restriction, which will result in the static pressure at the diffuser being too high at minimum flow conditions causing over-cooling/heating.

VARI-DISC VARIABLE GEOMETRY DIFFUSER PERFORMANCE

VCD VSD VRD

SIZE	READING	NECK TOTAL PRESSURE (Pa)								
		20	30	40	50	60	70	80	90	100
150	FLOW I/s	63	77	88	99	108	117	125	133	140
	THROW m	2.0	2.1	2.7	3.0	3.3	3.5	3.7	4.0	4.2
	NC LEVEL	-	-	-	-	26	28	31	33	35
200	FLOW I/s	96	118	137	153	169	184	195	207	218
	THROW m	2.0	2.6	3.0	3.2	3.6	3.9	4.2	4.5	4.7
	NC LEVEL	-	27	28	29	30	33	36	38	40
250	FLOW I/s	140	171	198	221	242	261	279	296	313
	THROW m	2.4	2.6	3.2	3.5	3.9	4.2	4.5	4.7	5.1
	NC LEVEL	-	27	29	31	33	36	38	40	42
300	FLOW I/s	176	216	250	280	307	332	355	377	398
	THROW m	2.5	2.8	3.3	3.7	4.2	4.6	4.8	5.2	5.4
	NC LEVEL	27	28	30	32	35	37	39	4.1	43
350	FLOW I/s	246	301	349	389	426	461	492	523	551
	THROW m	2.7	3.2	3.6	4.1	4.5	5.0	5.5	5.7	5.9
	NC LEVEL	27	28	30	32	35	38	40	43	45

SIZE	READING	NECK STATIC PRESSURE (Pa)				
		10	20	30	40	50
150	FLOW I/s	58	79	97	111	126
	THROW m	2.0	2.2	2.9	3.4	3.7
	NC LEVEL	-	-	-	27	31
200	FLOW I/s	82	114	140	163	185
	THROW m	1.6	2.5	3.0	3.4	3.9
	NC LEVEL	-	27	28	30	33
250	FLOW I/s	119	161	197	227	253
	THROW m	2.3	2.4	3.2	3.6	4.1
	NC LEVEL	-	26	29	32	35
300	FLOW I/s	145	198	241	278	311
	THROW m	2.3	2.5	3.2	3.7	4.3
	NC LEVEL	26	27	29	32	35
350	FLOW I/s	205	276	339	388	434
	THROW m	2.3	3.0	3.5	4.1	4.6
	NC LEVEL	26	27	29	32	36

Throw data is taken 25mm below the ceiling on a line through the centre of the diffuser with the control disc fully open & an 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 (i.e. the difference between Sound Pressure Level (dB re: 2x10⁻⁵ Pa) and Sound Pressure Level (dB re: 10⁻¹²) 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 diffuser air flow settings are approximate & may require to be reset on site to compensate for actual site system pressures.

VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

DIFFUSER MOUNTING METHODS

GENERAL

The basic VARI-DISC ceiling diffuser concept supports a wide range of diffusion unit styles. The basic diffuser usually drops into a square opening between ceiling tees. Ceiling openings need not be square and in fact, in the case of plastered ceilings, are often circular.

MOUNTING DIFFUSERS WITH SQUARE PLATES

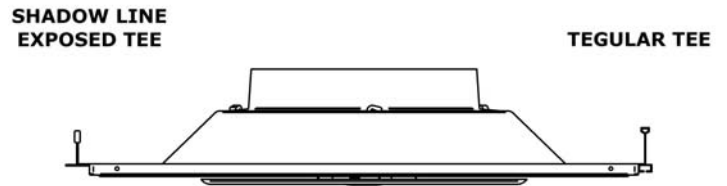
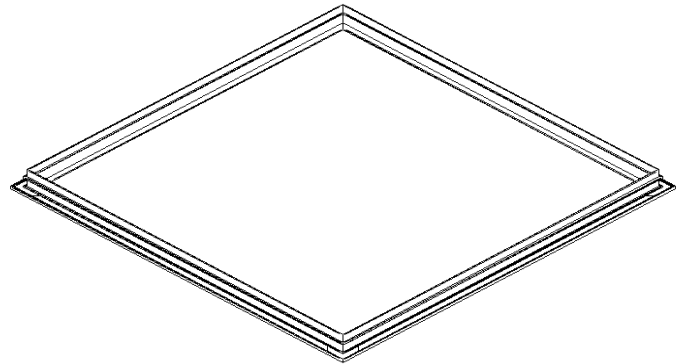
These can be supplied as standard with two different sizes of mounting plate, namely 495mm x 495mm & 595mm x 595mm to suit various types of ceilings. Specials sizes are available on request. Mounting plates may be supplied to suit the following types of ceilings, as shown in the sketches:

- Drop-in exposed tee
- Shadow line exposed tee
- Plastered ceiling
- Baffled ceiling

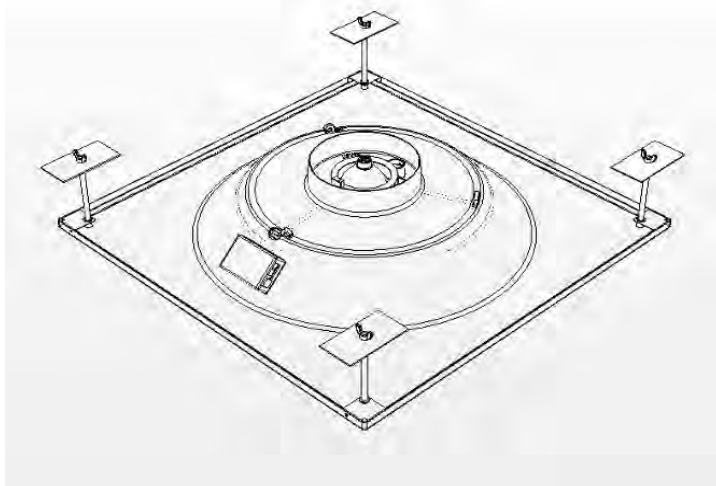
In the case of plastered ceilings two methods of fixing may be used and should be specified if required. Concealed fixing is achieved by four fixing studs secured on the corners of the mounting plate. These pass through the ceiling and, with the use of backing plates, are used to secure the diffuser to the ceiling. A further option for fixing into a plastered ceiling is with the use of a T-frame which is an optional extra. This is fixed to the ceiling and the diffuser then drops into it.

FIXING STUD POSITIONS	
PLATE SIZE mm	STUD CENTRES mm
495 x 495	445
595 x 595	545

DIFFUSER MOUNTING INTO PLASTERED CEILING



DIFFUSER MOUNTING INTO PLASTERED CEILING



Baffled ceilings require an unusual treatment which is not illustrated. Normally this ceiling requires a square tile with suspension points fitted at each corner thereby enabling support from the top edges of the baffles. Large diffuser mounting plates are particularly beneficial in the baffled ceiling as there is otherwise little opportunity for the coanda effect to help distribute conditioned air across the ceiling. This may result in inadequate throws and poor room air movement.

CIRCULAR DIFFUSERS

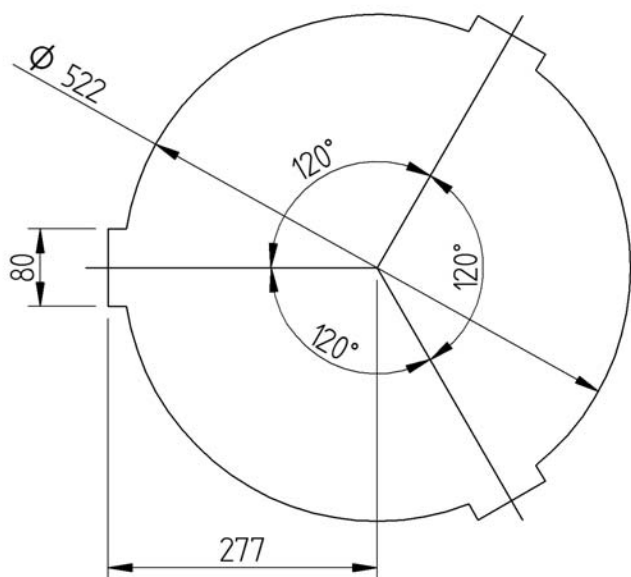
Apart from the usual four-corner style, the VARI-DISC is also available in a circular format. This model is most often combined with round down-lighters to preserve the circular pattern, and in particular with plastered ceilings. It also offers the absolute minimum interruption to the ceiling for those who prefer to have its unbroken regularity maintained.

Fixing of round diffusers in a plastered ceiling often presents a problem because of restricted access to the ceiling void. This problem is overcome with a diffuser that is fitted with three clips that allows the Diffuser to be twisted and clipped into a hole created in the ceiling. The installer need only cut a round hole with three notches (stencils provided with each order) and the diffuser twisted into place. Removal is as easy, a simple twist in the opposite direction and the round diffuser can be removed. The entire operation can be carried out without ever needing to enter the ceiling space.

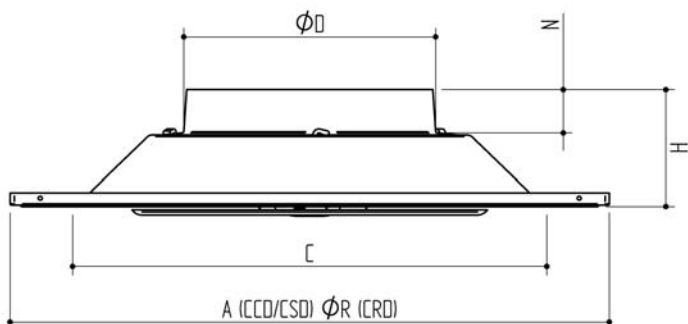
VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

CEILING CUT-OUT DETAIL FOR ROUND DIFFUSERS



CEILING DIFFUSER DIMENSIONS



NOMINAL SIZE	DIMENSIONS (mm)				
	Ø D	A	H	N	Ø R
150	153	495 x 495 595 x 595	102	28	580
200	200	495 x 495 595 x 595	104	33	580
250	250	495 x 495 595 x 595	100	34	580
300	293	495 x 495 595 x 595	100	35	580
350	346	595 x 595	106	43	580

VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

ELECTRIC HEATING

The RICKARD VSD/VCD/VRD ceiling diffusers may be fitted with electric re-heaters housed within a sleeve which slides into the standard diffuser neck. Heater elements used in the diffusers are “black heat” having a heat density of 3,2W/cm² and are of the stainless steel sheathed type, rated for 110, 208, 230 or 277 Volts. In all cases an auto-reset 65°±5°C and power-reset 85°C±5°C overheat safeties cutout are fitted. The “power reset” type is reset by turning the power supply off momentarily. Push-button type manual reset safeties are not recommended in conjunction with diffuser re-heaters.

For additional safety, RICKARD are able to offer an Airflow Switch to interrupt power to the re-heater controls when there is insufficient airflow across the heater element.

To ensure electrical safety our Triacs are fitted with a fuse to protect against large current surges and shorts and a transient suppressor protects against voltage surges.

Heaters are available in various capacities, ranging from 0.5kW to 2.5kW. When calculating heater capacities for VAV diffusers, please keep in mind that heating in the cooling mode takes place when the diffuser is supplying minimum air flow and care must therefore be taken to ensure that an excessive temperature rise in the diffuser is avoided. Discharge temperatures in excess of 32°C are likely to cause stratification within the room. As a guide-line, the temperature of the air leaving the diffuser should not be more than 10°C above actual room temperature. Kindly refer to the following table giving the maximum recommended heater output for each diffuser neck size. These heater output ratings have been computed on the basis that minimum air flow is 30% of maximum and the maximum capacity of the fitted re-heater is set electronically for an air temperature rise of no more than 17°C, a standard feature of the RICKARD MLM, Mini BMS and Interoperable BMS Compatible Controls.

NECK TOTAL PRESSURE (Pa)	30	50	70	90	FIXED HEATER CAPACITY (WATTS)
NECK DIAMETER (mm)	MAXIMUM HEATER OUTPUT (WATTS)				
150	400	500	600	685	750
200	720	940	1125	1250	1250
250	1050	1350	1600	1800	1500
300	1325	1700	2000	2000	2000
350	1850	2400	2500	2500	2500

IMPORTANT: These maximum capacities do not take into account limitations of the triac which is rated at 12A maximum. This reduces the capacity of the triac at low voltage supply.

For accurate control of room temperature, the electric re-heater is controlled on a step-less, proportional-integral basis. In addition to having a proportional-integral output signal for cooling control, the temperature controller also has a proportional-integral output signal for heating.

This is done by means of a triac switching set (current valve)

which varies the heater output capacity by cycling the power supply to the heater on and off – Pulse Width Modulation (PWM). This switching takes place over a cycle of approximately 2 seconds and always occurs at zero voltage to avoid radio frequency interference and voltage spikes. The “on” and “off” periods are varied in proportion to the amount of heating required, i.e., a required heating capacity of 75% will result in an “on” period of 1.5 seconds and an “off” period of 0.5 seconds.

In a situation where multiple diffusers are controlled from a single controller, each diffuser will be fitted with its own triac set that will receive a heating signal from the Master controller. The heating signal transmitted by the controller is a 9 Volt DC signal.

From the table “Maximum Heater Output (Watts)” in the previous column, it will be noted that for each neck total pressure there is a specific heater output quoted and for each diffuser size a standard heater capacity is referenced. For example, in the case of a VCD 250 diffuser, the re-heater sleeve would be factory fitted with a 1500 watt heater, which by utilizing the RICKARD MLM, Mini BMS or Interoperable BMS Compatible Controls, can be electronically set for any output from as little as 100 watts to 1500 watts to match the design engineer’s requirements for minimum cooling mode supply air flow and desired leaving air temperature. Therefore, if the diffuser neck total pressure were to be set at 50Pa and the minimum desired minimum air flow was 30% of maximum with 17°C air temperature rise, the heater output for a VCD 250 required would be 1350 watts, set by using a computer for the MLM, Mini BMS or Interoperable BMS Compatible Controls. Kindly refer to the help section in the MLM software program for more detailed information.

When the diffuser reaches its minimum supply air flow setting (also set electronically), if the room temperature set point is satisfied, no heating will occur. However, if the room temperature were to fall by 0.5°C below setpoint, the Triac Controller will commence energizing the heater and will fully energize the heater when the room temperature is approximately 1.5°C below setpoint. In between these two limits, heating capacity will modulate on a proportional-integral basis, saving energy since only the required heat is generated.

All electrical wiring associated with the re-heater is carried out in the factory and all units carefully tested for correct operation. The re-heater power supply should be interlocked with an air flow/pressure switch to isolate the heaters in the event of a loss of air flow.

VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

REVERSING CHANGEOVER

The RICKARD Reversing Changeover facility will allow the VAV diffuser to control the supply air volume in both heating and cooling mode, i.e., when the central system is supplying either warm or cold air.

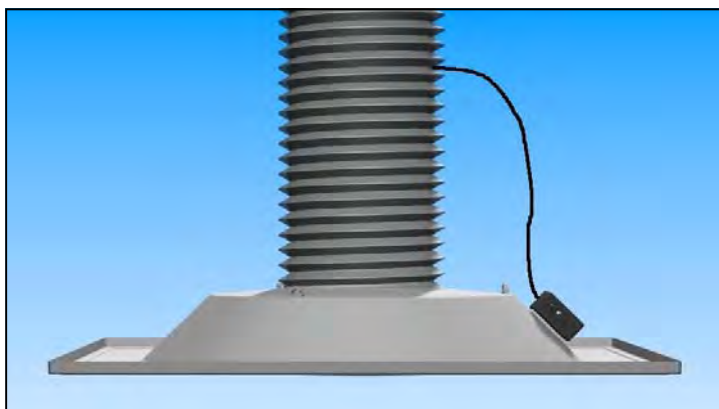
When the system switches to heating mode, the changeover sensor detects the increase in supply air temperature and switches the direction in which the actuator operates. This means that when the system is in cooling mode, the diffuser will drive open as the room temperature increases, whereas in the heating mode the diffuser will close as the room temperature increases.

Converting the standard RICKARD temperature controller to incorporate the changeover facility is a simple matter of adding the additional plug-in supply air temperature sensor, as shown in the diagram. This temperature sensor must be fitted in such a way that it senses the primary air temperature being supplied to the diffuser. **NOTE:** Slave diffusers receive a control signal from the master diffuser and therefore do not require nor must they be fitted with a changeover sensor. If a re-heater is fitted to the neck of the diffuser, care must be taken to ensure that, the Changeover Sensor is installed in such a way that it is not affected by radiant heat from the heater. The controller compares the primary air and the room air

temperatures and whenever the supply air temperature exceeds the room temperature, the control action is reversed and is switched into heating mode. Cooling mode is re-instated when the primary air temperature falls below room temperature.

Should a VAV air diffusion unit be fitted with a re-heater, the heater will be proportionally energized between 0.5°C and 1.5° C below setpoint temperature, regardless of which mode the controller is in. Effectively, therefore, a re-heater will only be energized at Minimum Supply Air Status in the cooling mode and at Maximum Supply Air Status when in the heating mode. This control logic is from a Green Building perspective extremely energy efficient.

FIT CHANGE-OVER SENSOR AS FAR UP THE FLEX AS POSSIBLE



VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

GREEN BUILDING BENEFITS

INTRODUCTION

There is an increased focus on green in modern buildings, and a focus to improve the green rating of existing buildings.

This section highlights how Rickard product may help to get a building project certified as green.

Rickard low pressure VAV diffusers can have an impact the following green credits

- Management credits
- Indoor Environmental Quality credits
- Energy credits

MANAGEMENT CREDITS

BUILDING TUNING

Diffusers are self balancing, and fine-tune air delivery to the precise needs of the office.

This is achieved through the modulation of a diffuser control disc that is activated by electronic controls to ensure that the correct amount of air is released into the room thereby controlling room conditions.

THE RICKARD VARIABLE AIR VOLUME SYSTEM

The world's consciousness for the need to conserve energy accelerated the tendency for designers to use VAV as the most economical and efficient solution to the problems posed by the multizone requirements of modern buildings. Unquestionably no other system offers such low operating costs and such flexibility in its application to multizone air conditioning diversities.



COMMISSIONING

Since these diffusers are essentially self balancing, there is no need to balance the airflow to every variable geometry diffuser. The commissioning engineer need only ensure that the diffuser most likely to be starved from air, typically at the end of the run, has enough air at maximum load conditions. See the detailed commissioning guide for more information.

INFORMATION MANAGEMENT

Modern BMS compatible VAV diffuser controls allow for intelligent building and central plant decisions based on information available from every diffuser. Building conditions can be controlled and modified centrally. See MLM controls booklet for more information.

INDOOR ENVIRONMENTAL QUALITY CREDITS

INDIVIDUAL COMFORT CONTROL

Every Variable Geometry VAV diffuser can individually control conditions in the occupied space where it is fitted. Every diffuser can be fitted with an on-board space sensor, or a Wall mounted space sensor with set point adjustment capabilities.

THERMAL COMFORT

Compliance with Ashrae 55-1992 is possible when using VAV diffusers. A VAV Diffuser is the only HVAC product that directly effects comfort.

AIR CHANGE EFFECTIVENESS

Rickard VAV diffusers will ensure that air is mixed effectively in the occupied space even when supplying Minimum Air volumes.

THE RICKARD VARIABLE AIR VOLUME SYSTEM

The world's consciousness for the need to conserve energy accelerated the tendency for designers to use VAV as the most economical and efficient solution to the problems posed by the multizone requirements of modern buildings. Unquestionably no other system offers such low operating costs and such flexibility in its application to multizone air conditioning diversities.



ENERGY CREDITS

ENERGY IMPROVEMENT

Low Pressure VAV diffusers save energy due to the following benefits:

- Rickard VAV diffusers eliminate the pressure drop associated with VAV boxes required in a VAV box variable volume air supply system. This result in a central plant that use less Fan energy.
- Rickard VAV diffusers save energy since no area in the building is over cooled, or over heated. Every diffuser measures local space conditions and varies the amount of air to meet the demands of that area.
- Rickard VAV diffusers with MLM BMS compatible controls can use occupancy sensors to ensure that occupied spaces are supplied only. This can save a huge amount of energy since only 50% to 70% of space, depending on the type of building, is occupied at any one time during business hours.

ELECTRICAL AND TENANCY SUB-METERING

Sub-metering can be achieved because Rickard Controls and Neck Heaters are powered via separate circuits.

PEAK ENERGY DEMAND REDUCTION

Heating on different diffusers can be staggered to reduce total building peak demand.

Heater output can be limited per zone or per diffuser to reduce power requirements during peak demand periods.

VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

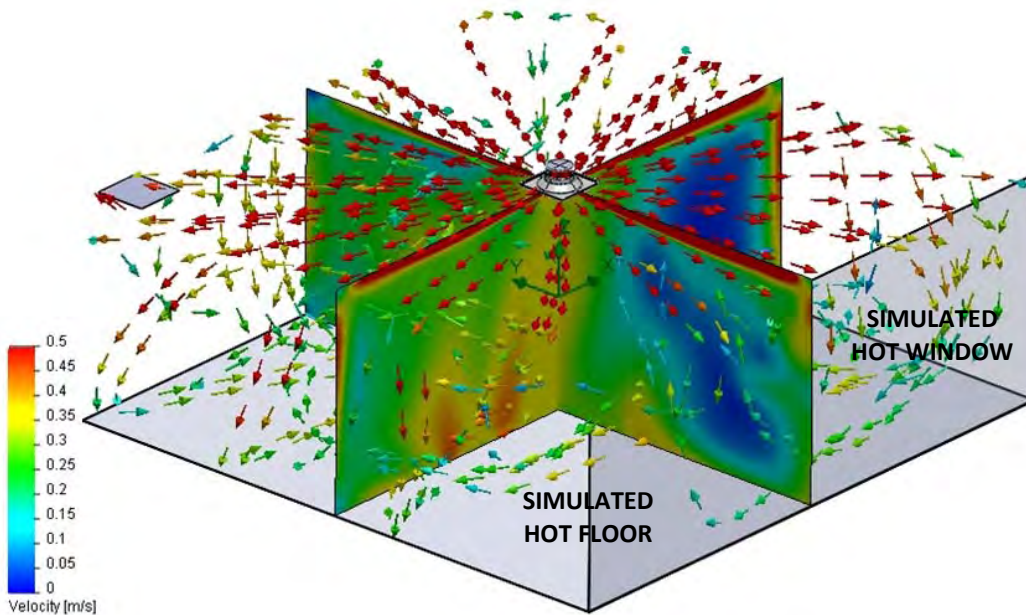
THROW AND EXIT VELOCITY

It is a feature of the variable geometry VAV diffuser concept to maintain throw at an acceptable level throughout the range of air flows. This is achieved by changing the exit geometry for reduced airflow, This maintains the exit velocity, which in return will maintain the throw. Throw is the distance from the diffuser at which the air velocity drops below 0.25 m/s.

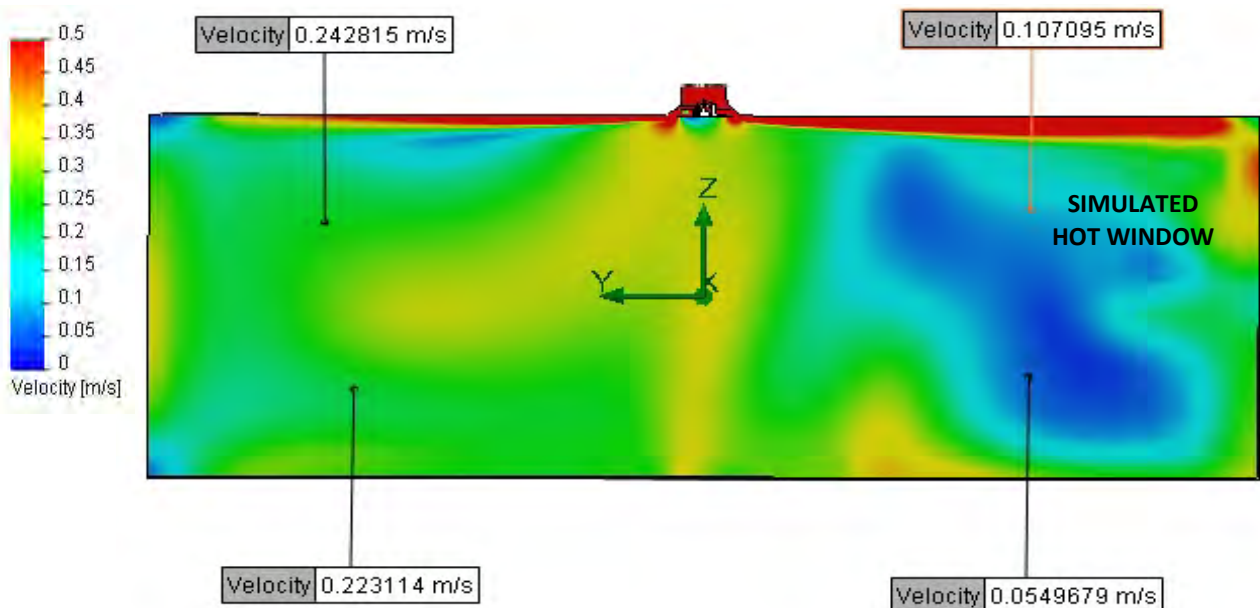
If air velocity is too high in the occupied space, drafts will be experienced and ADPI values will suffer.

VAV diffusers rely on a high velocity air stream to maintain coanda and throw next to the ceiling. Care must be taken to select the correct diffuser for the size of the space and to meet load requirements.

Correctly selected diffusers allow for effective room air circulation without drafts as shown in the CFD analysis below.



**3D VELOCITY VECTOR PLOT for a VCD 300mm DIFFUSER
 (Control disc 30% open; Supply 12°C; Room 7m by 7m)**



**2D VELOCITY VECTOR PLOT for a VCD 300mm DIFFUSER
 (Control disc 30% open; Supply 12°C; Room 7m by 7m)**

VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

AIR CHANGE EFFECTIVENESS

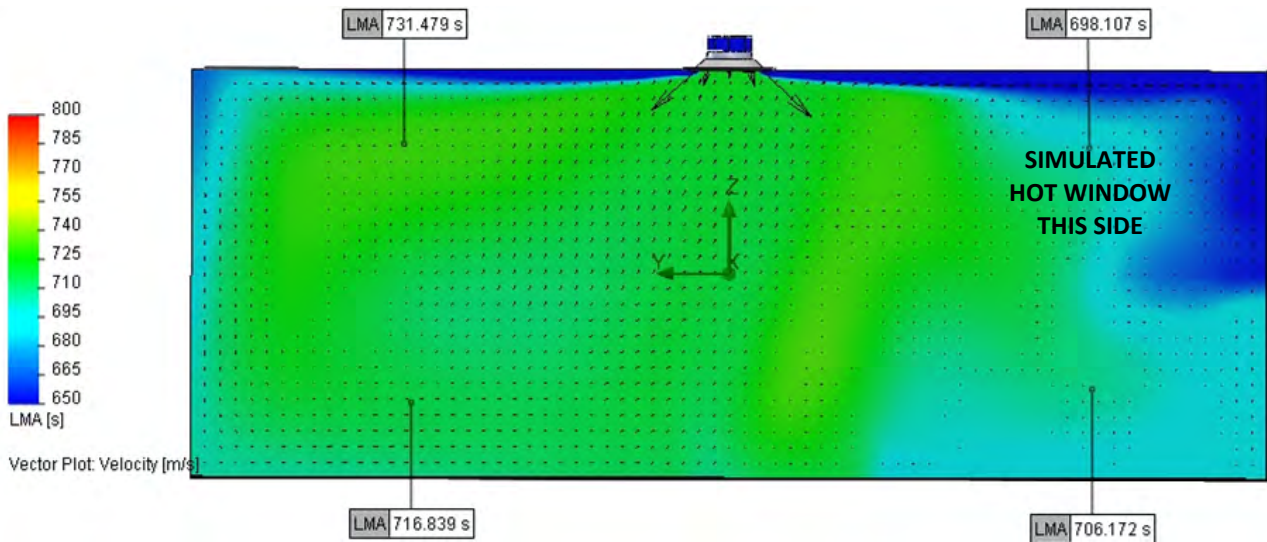
Air Change Effectiveness (ACE), is defined as the age of air that would occur throughout the room if the air was perfectly mixed, divided by the average age of the air that occupants would inhale.

An Air Change Effectiveness of 1 indicates perfect uniform mixing in the room. If ACE is lower than 1, it is an indication that the air is short-circuiting between the supply air diffuser and the return air grill.

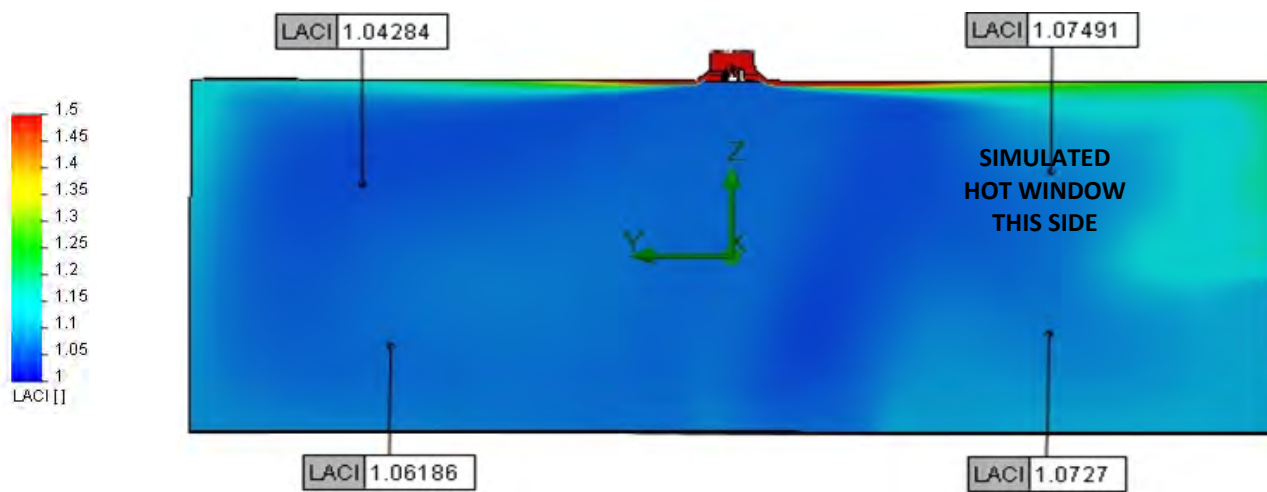
An ACE value of higher than 1 is possible when air diffusion allows a higher ventilation rate in the occupied space than in the rest of the room.

Low Pressure VAV diffusers maintain acceptable Air Change Effectiveness values even when turned down to minimum supply air volumes.

The CFD clip below gives an representation of the Mean Age of the Air throughout a typical room that is fitted with a Variable Geometry VAV diffuser.



**2D PLOT of LOCAL MEAN AGE of AIR for a VCD 300mm DIFFUSER
 (Control disc 30% open; Supply 12°C; Room 7m by 7m)**



**2D PLOT of LOCAL AIR CHANGE INDEX (LACI) for a VCD 300mm DIFFUSER
 (Control disc 30% open; Supply 12°C; Room 7m by 7m)**

LACI close to 1 indicates acceptable room air mixing
 $LACI = LMA / \text{time taken to fill room with air}$

VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

ADPI PERFORMANCE

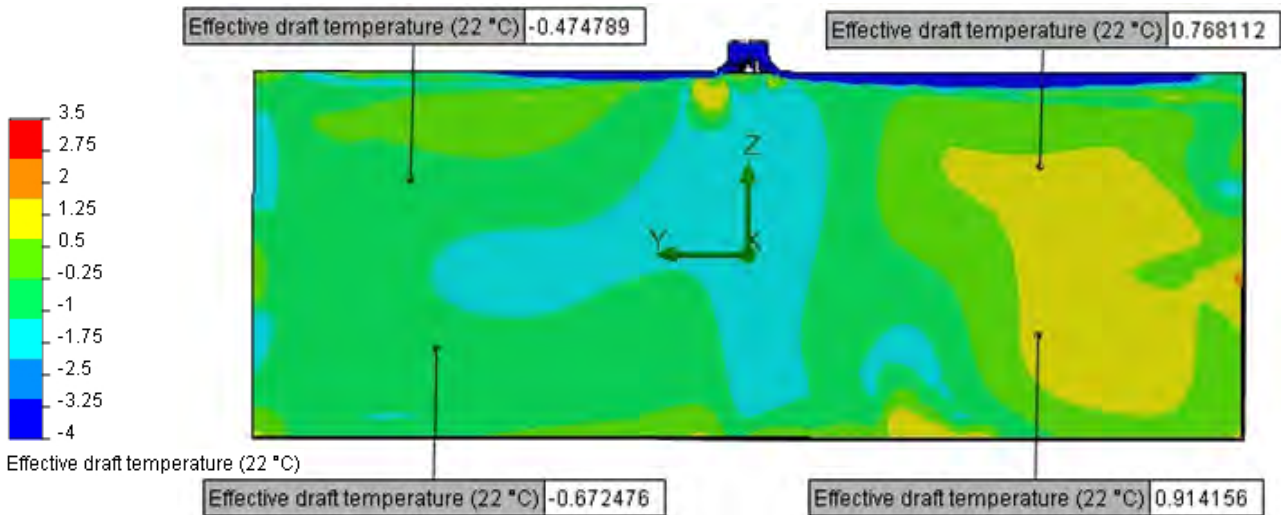
Air Diffusion Performance Index (ADPI) statistically relates the air temperature and air speed in the occupied space to the occupants' thermal comfort.

ADPI is calculated as the percentage of locations in the conditioned space that meet comfort standards.

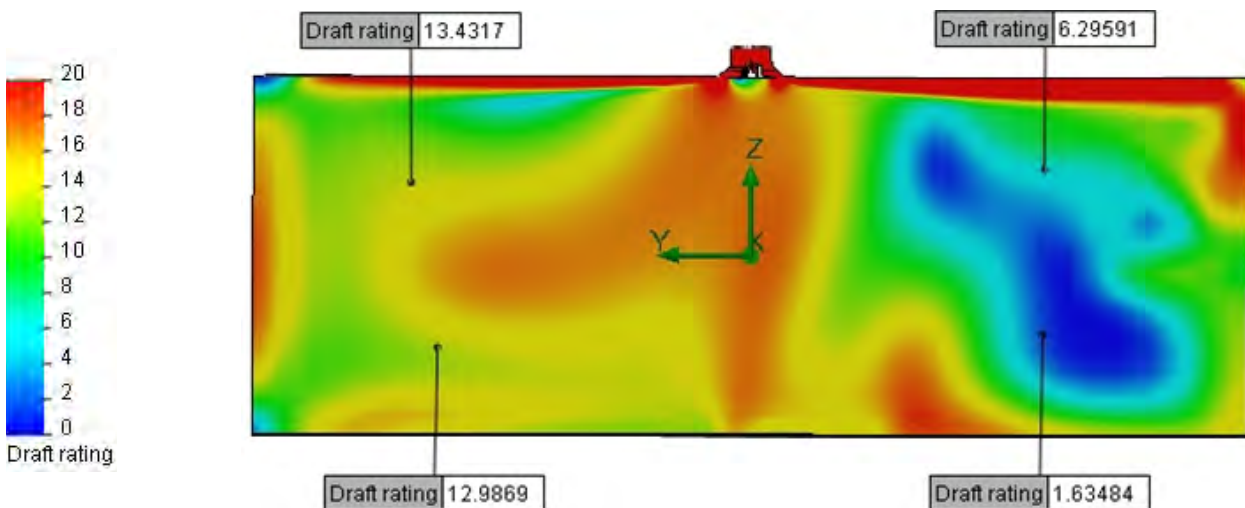
The "2009 Ashrae Handbook: Fundamentals" indicates that conditions in the occupied space is acceptable when:

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

Rickard VAV diffusers that are correctly selected for the size of the occupied space and the load in the occupied space, will maintain good ADPI values throughout the range of control disc movement.



**2D PLOT of EFFECTIVE DRAFT TEMPERATURE for a VCD 300mm DIFFUSER
 (Control disc 30% open; Supply 12°C; Room 7m by 7m)**



**2D PLOT of DRAFT RATING for a VCD 300mm DIFFUSER
 (Control disc 30% open; Supply 12°C; Room 7m by 7m)**

VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

ON-BOARD SENSING

It is possible to sense the temperature of the occupied space on the Rickard Diffuser Trim plate.

The following issues have to be considered:

- Back-end cooling or heating.
- Sensor positioning and configuration.
- Room stratification levels.
- Throw and effective Air Circulation and Ventilation.
- Specific Room Conditions.
- Electronic compensation.

BACK-END COOLING AND HEATING

The biggest risk associated with on-board sensing relates to the effect of supply air at the neck of the diffuser on the sensed room temperature value.

Typically the supply air will be far colder or hotter than the actual room temperature. Due to the proximity of the sensor to supply air, there is a big risk that the sensor will not read room temperature accurately.

This problem is even bigger when the difference between room and supply air increase as is the case with modern low temperature supply designs.

SENSOR POSITIONING AND CONFIGURATION

Rickard reduced the effect of Back-end Cooling or Heating by implementing an innovative forced induction system on our plate diffusers. This system uses a venturi system to induce room air onto the sensor.

NB!! The detail positioning and sealing of the sensor and induction channel is very important to achieve accurate sensing.

This system can read temperature in the room to an accuracy of 1 deg C subject to the following conditions:

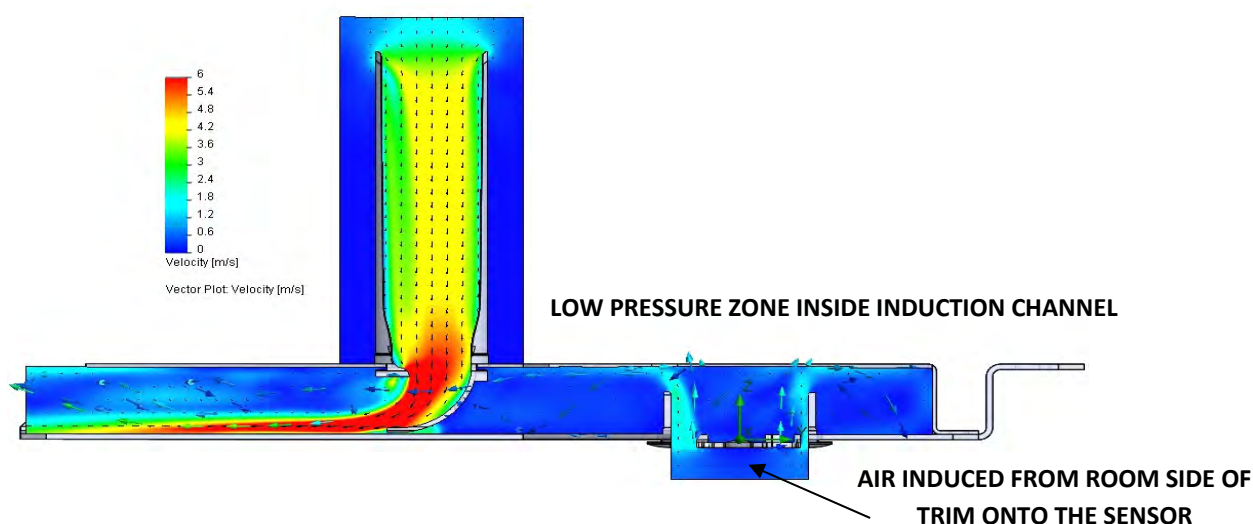
- The Supply Temperature must be within 10°C of Room temperature.
- The correct diffusers must be selected to meet the cooling or heating demand, and must ensure the required Ventilation rates.
- The sensor must be fitted by Rickard staff.
- Limited Room stratification.

ROOM STRATIFICATION LEVELS

Stratification in the room occurs due to problems with the mixing of different air pockets or layers at different temperatures. The following must be considered to limit stratification:

- Maximum difference between Supply Air and room temperature should be around 10°C.
- The diffusers must be selected to achieve effective room air circulation and to meet demand.
- A diffuser that is selected incorrectly, will not be able to break up the stratification levels, resulting in the induction of air onto the sensor that does not represent the room conditions.
- Morning start-up can provide challenging conditions. Typically in winter when the room could be at 14°C. Maximum heating could be supplied at 40°C. The difference between room and supply can therefore be very high. It is recommended to keep neck pressure as high as possible under these conditions so as to ensure a high exit velocity that results in good mixing of air inside the room.

VENTURI SYSTEM USING SUPPLY AIR TO INDUCE ROOM AIR ONTO THE SENSOR



VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

ON-BOARD SENSING CONTINUED

THROW, AIR CIRCULATION AND VENTILATION

- Sufficient pressure must be maintained at the neck of the diffuser to maintain exit velocity.
- A variable geometry VAV diffuser must be used to maintain exit velocity when volume flow needs to be reduced.
- A diffuser must with sufficient throw needs to be selected to ensure effective Room Air Circulation to Ventilate the entire room.
- The aim is to effectively mix all the air in the room to ensure that the air induced over the sensor is representative of the conditions in the room.

SPECIFIC ROOM CONDITIONS

- Unusual concentrated load sources can influence mixing of air in the room. Examples:
 - Window Façade can transmit cold or hot outside conditions into the occupied space.
 - Computers or other equipment and machinery can be a source of heat.
- The HVAC design must accommodate for these localized influences. A VAV diffuser can be fitted with a Wall thermostat that will provide localized sensing at the position in the room where temperature control is required. Each VAV diffuser can be fitted with it's own Wall Thermostat.

ELECTRONIC COMPENSATION

Electronic compensation for incorrect sensor readings is possible. Rickard have developed an electronic compensation system that adjusts the amount of compensation as the difference between supply and room temperature increases.

A change over sensor must be fitted to measure supply air temperature, for the system to compensate correctly. If no change over sensor is fitted, the system assumes the supply temperature is 10°C lower than setpoint.

If compensation of 1°C is chosen the following actual offset in the reading will be applied:

- If supply is 10°C higher than setpoint, 1°C will be subtracted from the actual reading.
- If supply is 5°C higher than setpoint, 0.5°C compensation will be subtracted from the actual reading.
- If supply is 10°C lower than setpoint, 1°C will be added to the actual reading.
- If supply is 5°C lower than setpoint, 0.5°C compensation will be added to the actual reading
- If supply is same as setpoint, no adjustment will be made.

VARI-DISC VARIABLE GEOMETRY

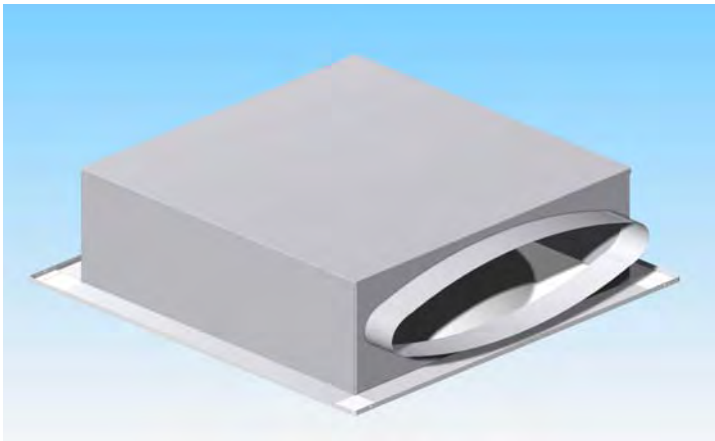
VAV CEILING DIFFUSER

OTHER OPTIONS

CEILING DIFFUSER SIDE ENTRY PLENUMS

In some building installations the ceiling space may be insufficient to fit a standard ceiling diffuser with a flexible duct connection from the top. To overcome this problem, side entry plenums can be specified as an optional extra for square ceiling diffusers. Contact your nearest sales office for details. Please note that this option is not available for circular diffusers.

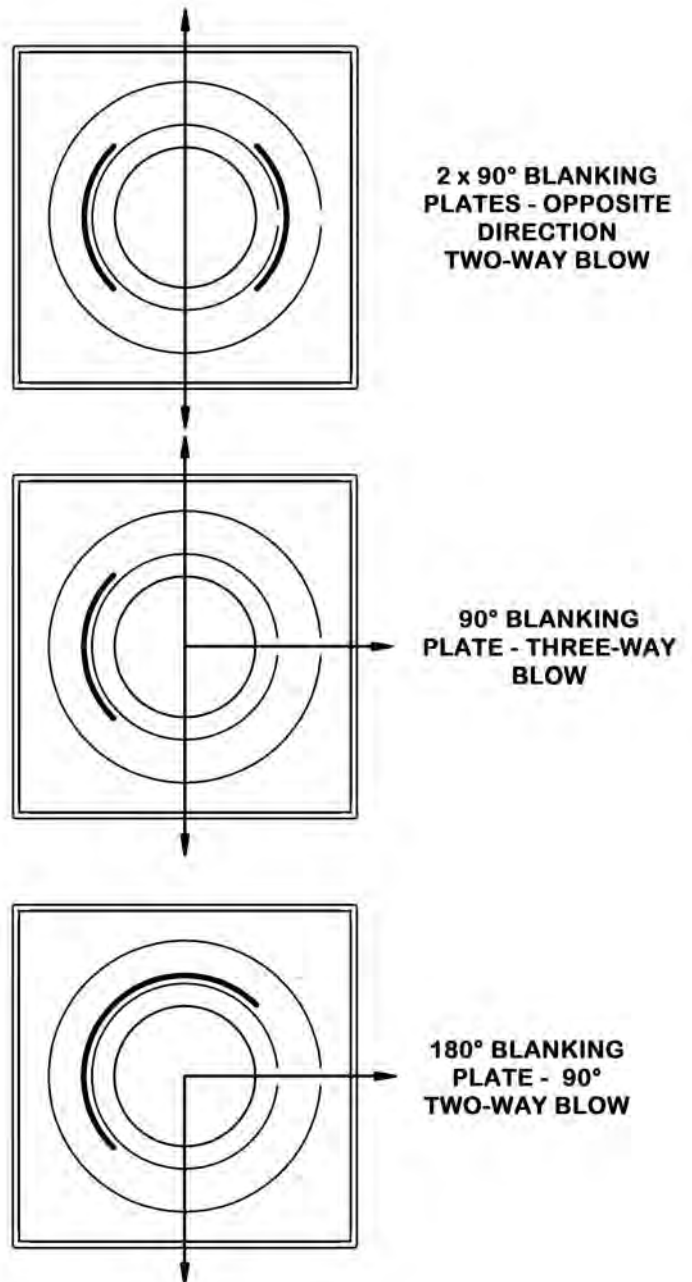
For larger diffuser neck sizes the entry collar on the plenum is in an elliptical shape. This ensures the lowest possible plenum height, easy fitting of the flexible duct over the collar and proper sealing around the entire circumference between the flexible duct and the collar. The nominal height for VCD and VSD diffuser with side entry plenums is 250mm .



CEILING DIFFUSER DIRECTIONAL BLOW OPTIONS

Supply air directional blanking for RICKARD VCD, VSD & VRD ceiling diffusers is achieved by fitting blanking plates. These blanking plates are fixed to the diffuser trim plate and are available in 90° and 180° sizes. Please specify diffuser neck size and trim size (large or small)

270°(Three-way blow), 180° (Two-way blow) or opposite side (Two-way blow) can be achieved using different configurations of blanking plates (Please see opposite diagram). Please note that throw data presented in the catalogue will no longer be valid when blanking plates are installed. The catalogued data covers 360° blow only.



VARI-DISC VARIABLE GEOMETRY

VAV CEILING DIFFUSER

OTHER OPTIONS

REVERSING CHANGEOVER

The RICKARD Reversing Changeover facility will allow the VAV diffuser to control the supply air volume in both heating and cooling mode, i.e., when the central system is supplying either warm or cold air.

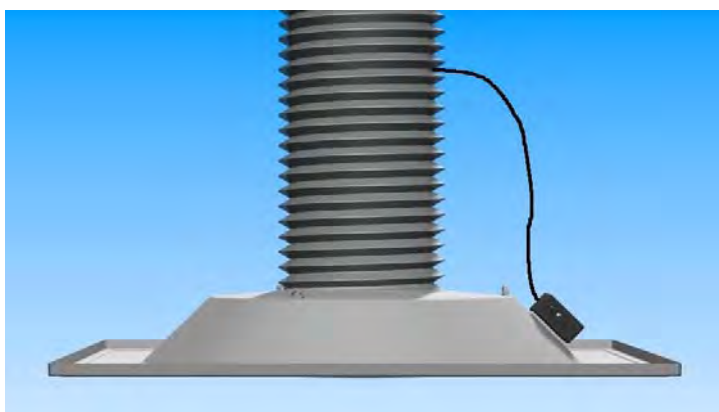
When the system switches to heating mode, the changeover sensor detects the increase in supply air temperature and switches the direction in which the actuator operates. This means that when the system is in cooling mode, the diffuser will drive open as the room temperature increases, whereas in the heating mode the diffuser will close as the room temperature increases.

Converting the standard RICKARD temperature controller to incorporate the changeover facility is a simple matter of adding the additional plug-in supply air temperature sensor, as shown in the diagram. This temperature sensor must be fitted in such a way that it senses the primary air temperature being supplied to the diffuser. Slave diffusers receive a control signal from the master diffuser and therefore do not require and **must not be fitted** with a changeover sensor. If a re-heater is fitted to the neck of the diffuser, care must be taken to ensure that, the Changeover Sensor is installed in such a way that it is not affected by radiant heat from the heater.

The controller compares the primary air and the room air temperatures and whenever the supply air temperature exceeds the room temperature, the control action is reversed and is switched into heating mode. Cooling mode is re-instated when the primary air temperature falls below room temperature.

Should a VAV air diffusion unit be fitted with a re-heater, the heater will be proportionally energized between 0.5°C and 1.5° C below setpoint temperature, regardless of which mode the controller is in. Effectively, therefore, a re-heater will only be energized at Minimum Supply Air Status in the cooling mode and at Maximum Supply Air Status when in the heating mode. This control strategy is extremely energy efficient and adds to a Buildings Green Benefits.

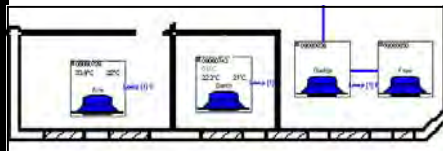
FIT CHANGE-OVER SENSOR AS FAR UP THE FLEX AS POSSIBLE



MLM VAV DIFFUSER CONTROLS

THE GREEN HVAC SOLUTION

FEATURE LIST

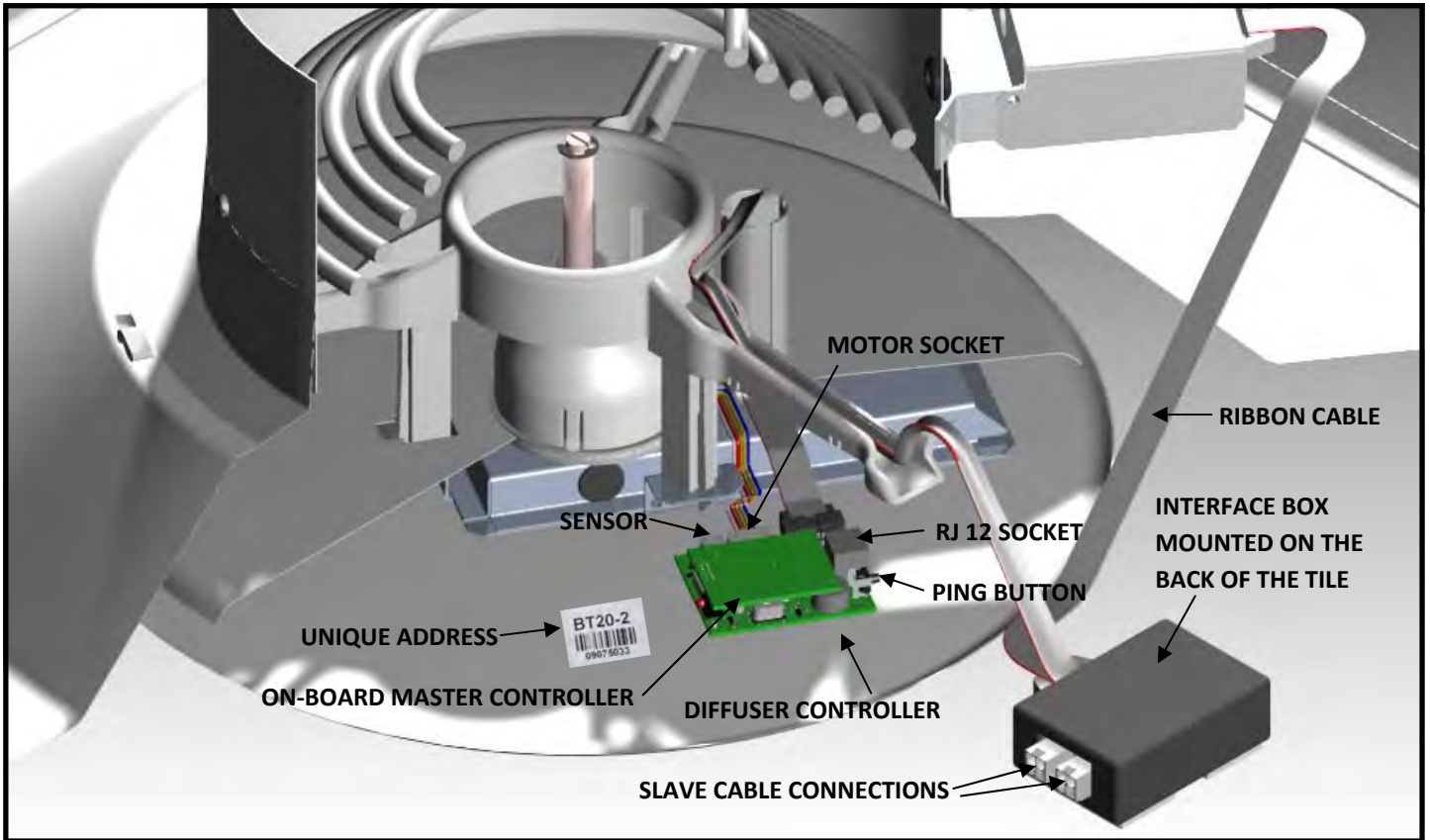


<p>GREEN BUILDING BENEFITS</p>	<ul style="list-style-type: none"> • Management Credits • Indoor Environmental Quality Credits • Energy Efficiency Credits
<p>EASE OF INSTALLATION</p>	<ul style="list-style-type: none"> • Simple daisy chain connections between diffusers • Master and Slave as above • Wrong connections eliminated
<p>EASY COMMISSIONING</p>	<ul style="list-style-type: none"> • Master Slave relationships set via PC or Remote • All Commissioning done from below the ceiling • Save Commissioning Data
<p>LOGGING CAPABILITY</p>	<ul style="list-style-type: none"> • Log commissioning data • Log Diffuser and Room Data • Fault Reporting
<p>SIMPLE DIFFUSER TUNING</p>	<ul style="list-style-type: none"> • PC adjustment of Diffuser MIN stops • PC adjustment of Diffuser MAX stops • PC adjustment of HEATER MAX
<p>EASY LAYOUT CHANGES</p>	<ul style="list-style-type: none"> • Easy conversion from SLAVE to MASTER • MASTER - SLAVE changes are done below the ceiling • PLUG & PLAY
<p>CONDITION MONITORING</p>	<ul style="list-style-type: none"> • PC Monitoring of Room Conditions • Logging of diffuser and Room Data • Queries Resolved Centrally
<p>FAULT MONITORING</p>	<ul style="list-style-type: none"> • Motor Fault Reporting • Motor Over Current Reporting • Room Condition Reporting
<p>MODULAR DESIGN</p>	<ul style="list-style-type: none"> • Save Cost by purchasing a stand alone system initially • Upgrade to Rickard mini BMS • Upgrade further to LONworks or BacNet
<p>NETWORKING CAPABILITY</p>	<ul style="list-style-type: none"> • Cost effective standalone BMS • LonWorks compatible BMS • BACnet compatible BMS
<p>RELIABILITY</p>	<ul style="list-style-type: none"> • Motor has passed life cycle testing the equivalent of 30 years. Basis: 3000 operating hours and 4000 control cycles per year • Automotive grade connectors • 31 years of VAV experience

MLM VAV DIFFUSER CONTROLS

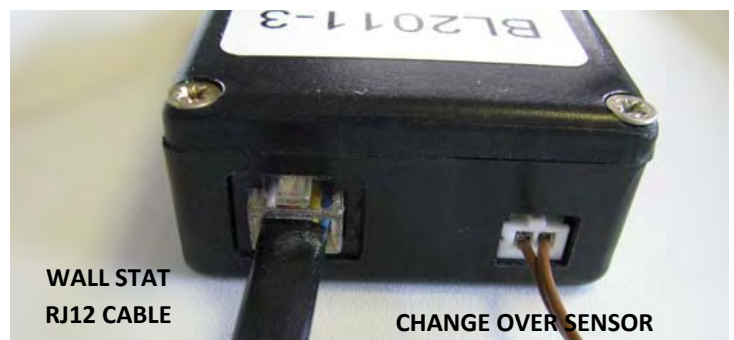
THE GREEN HVAC SOLUTION

SYSTEM ARCHITECTURE



- All Diffusers are fitted with a Diffuser Controller.
- This board is typically fitted inside the trim plate of a diffuser and interfaces with the motor and on-board sensor.
- Every Diffuser Controller is supplied with an unique address. Two labels, one applied to the trim plaque and another that can be removed for placement on a layout diagram are supplied.
- A ping button is fitted on the side of the Diffuser Controller for identifying the diffuser on the MLM software. This button can also be used in conjunction with a set-up module for commissioning.
- A set-up module can be plugged into the RJ12 female socket located on the diffuser controller. It is accessible from within the room on the trim plaque.
- A temperature sensor is fitted inside the sensor cap on the trim plaque of every diffuser. This enables diffuser conversion to a Master diffuser without complicated modifications or going into the ceiling.
- The conversion from Slave to on-board Master simply requires an on-board Master Controller to be plugged into the Diffuser Controller.
- A ribbon cable is provided to link the Diffuser Controller to the 24V Interface Board on the back of the diffuser tile. A Female RJ12 socket is provided on the 24V Interface box for connection of the Wall Thermostats set-point adjuster option.
- A connector is also provided for the Change Over Sensor.

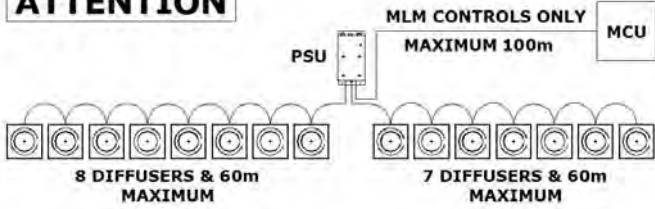
- A 24V Power Pack is provided to supply Power to 15 diffusers.
- The 24V Interface Board is fitted with 2 Female Microfit Sockets.



MLM VAV DIFFUSER CONTROLS **THE GREEN HVAC SOLUTION**

SYSTEM ARCHITECTURE

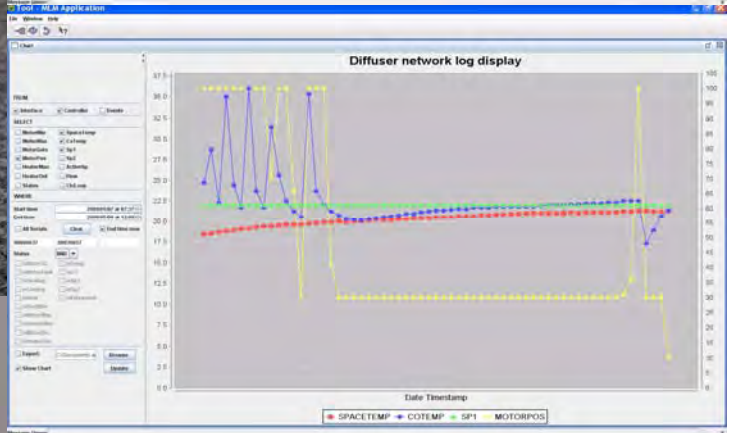
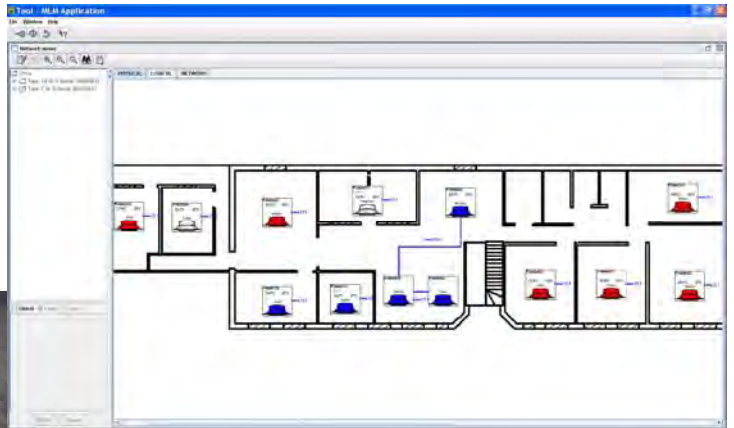
ATTENTION



as well as heater MAX.

- Ease Building Management using PC.
- Central Set-point over-ride by building administrator.
- Project Selector system allows for easy navigation between floors and sections.
- Logging of a wide range of room conditions with graphic capabilities.
- Logging of faults and changes in the system.

- Two Female Microfit connectors are fitted to one end of the Power Pack for slaving purposes. Same cables are daisy chained as shown above.
- Seven diffusers can be daisy chained from one connector and 8 diffusers from another.
- A third RJ9 connector is for networking to a Master Communications Module, LON or BacNet Module. An USB module can also be connected for commissioning or building Maintenance purposes.



MLM SOFTWARE APPLICATION

- The MLM software is supplied for free when you purchase MLM Controls
- The Software incorporates a comprehensive help file.
- Commissioning of Controls and Diffusers made easy with back-up facility.
- Master –Slave relationship changes.
- Fine-tuning of building by adjusting diffuser MAX or MIN air

MLM VAV DIFFUSER CONTROLS

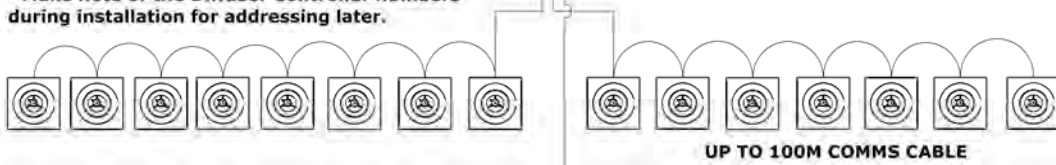
THE GREEN HVAC SOLUTION

SYSTEM ARCHITECTURE

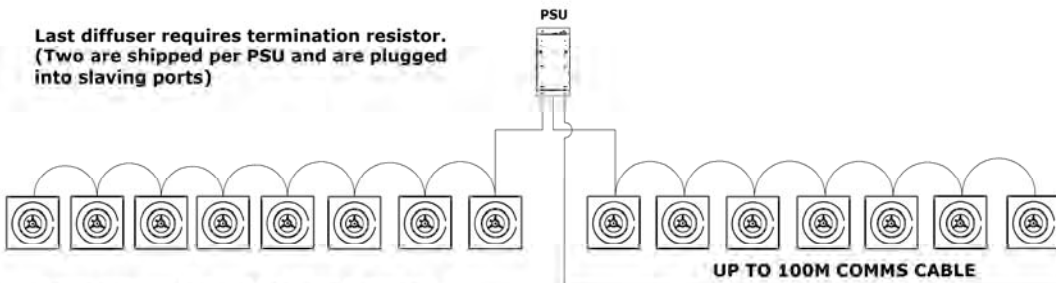
- 1 PSU Supplies a max of 15 Diffusers. Two ports. Max 8 on one port, 7 on the other.
- Max cable length 60 meters total per side. (Std 6 meters/diffuser but can be extended to 12 meters by joining two cables. 8 meter cables are available on demand. (Can be doubled to 16 m) Joining a cable reduces the total no of diffusers/PSU by one each time.
- Daisy chain connection between diffusers.
- No cable differences between master or slaves.
- Make note of the Diffuser Controller numbers during installation for addressing later.

- PSU Options:**
 (40VA power)
 1) 220v to 24V
 2) 115V to 24V
 3) Moulded plug
 4) Special plug

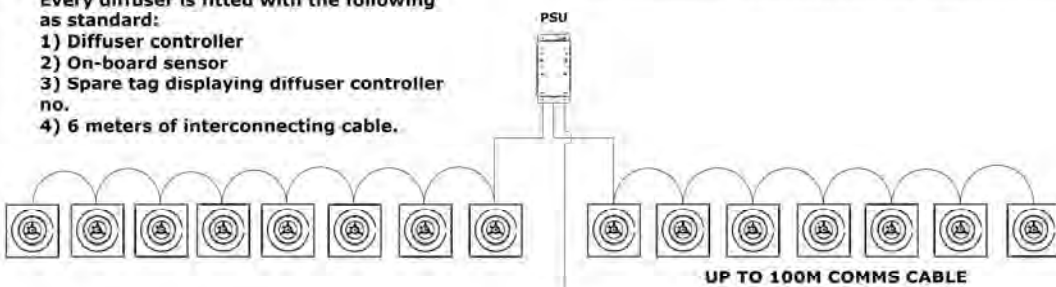
- 1 Master Communication Unit (MCU) max 4 Power Supplies (PSU).
- RJ9 communications cable to each PSU (20 to 100 meters long Max). 220V/5A Power requirement. BMS network must be grounded to Rickard specification. (MCU ONLY REQUIRED WHEN BMS CONTROL REQUIRED!!)



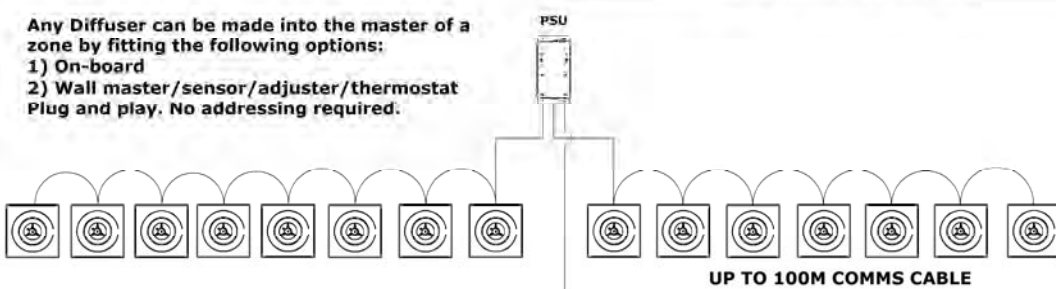
Last diffuser requires termination resistor. (Two are shipped per PSU and are plugged into slaving ports)



- Every diffuser is fitted with the following as standard:
- 1) Diffuser controller
 - 2) On-board sensor
 - 3) Spare tag displaying diffuser controller no.
 - 4) 6 meters of interconnecting cable.



- Any Diffuser can be made into the master of a zone by fitting the following options:
- 1) On-board
 - 2) Wall master/sensor/adjuster/thermostat Plug and play. No addressing required.



- PC Front End Options:**
 1) Rickard application
 2) BACNet
 3) LON

- MCU Options:**
 1) Rickard using TCP/IP network
 2) BacNet using TCP/IP network
 3) BacNet using MS/TP network
 4) LON with twisted pair network

- USB module:**
 (Can be used in the place of an MCU for linking to a diffuser network for commissioning or maintenance)
 Plug into:
 1) PSU
 2) Diffuser controller
 1 USB Suggested per site

WARRANTY

Rickard Air Diffusion (Pty) Ltd. warrants that its VSD/VCD1 electronic diffusers, including options or accessories shall be free from defects in material or workmanship for a period of two years from the date of shipment and agrees to repair or replace, at its option, any parts that fail during said period due to any such defects which would not have occurred had reasonable care been taken, provided that such parts have been inspected by Rickard and found defective and provided the diffusers have been given normal and proper usage and all parts and controls remain unaltered.

Rickard makes no warranty of merchantability of products or of their fitness for any other express or implied warranty which

extends beyond the limited warranty above. Rickard's liability for any and all losses and damages resulting from defects shall in no event exceed the cost of repair or replacement of parts found defective upon examination by Rickard. In no event shall Rickard be liable for incidental, indirect or consequential damages or damages or injury to persons or property. Rickard shall not be responsible for freight to or from its premises in connection with the inspection repair or replacement or parts under the terms of this limited warranty nor for the cost of removal or installation.

This warranty excludes any non standard options or accessories installed in the field or factory.



INTELLIGENT COMFORT CONTROL

Rickard Air Diffusion (Pty) Ltd

16 Harris Drive P.O. Box 103

Ottery 7808 Cape Town RSA

T: +27 21 704 1533 F: +27 21 704 1004

info@rickardair.com

www.rickardair.com