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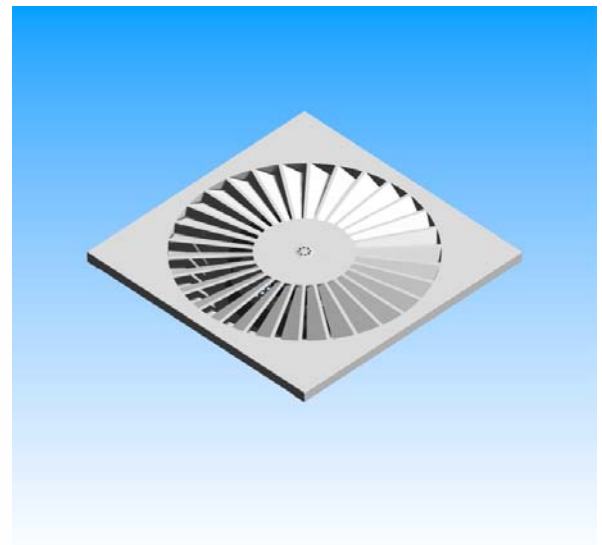
SWIRL TYPE VARIABLE VOLUME CEILING DIFFUSERS

APPLICATIONS

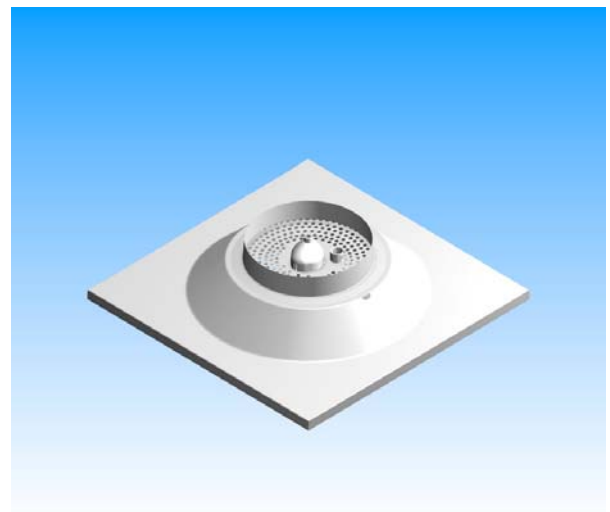
- ◆ VAV COOLING & HEATING
- ◆ PROPORTIONAL TERMINAL REHEAT
- ◆ STAND ALONE OR BMS CONTROLS
- ◆ WITH or WITHOUT REMOTE SETPOINT

ADVANTAGES

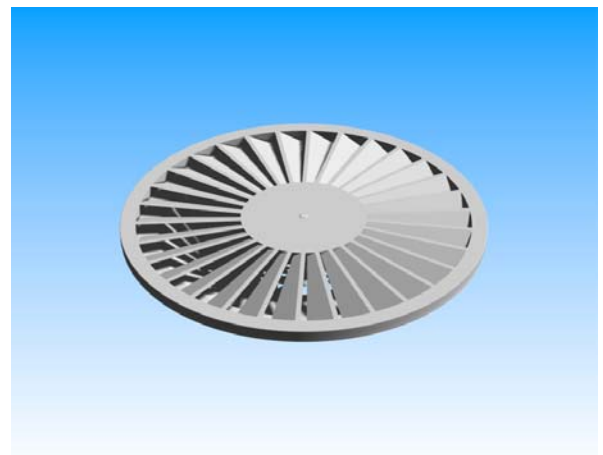
- ◆ ELECTRIC & PNEUMATIC ACTUATORS
- ◆ SLAVING OPTION
- ◆ AUTO Matic HEAT-COOL CHANGE-OVER
- ◆ NO REGULAR MAINTENANCE



VSW



VSW



VRW

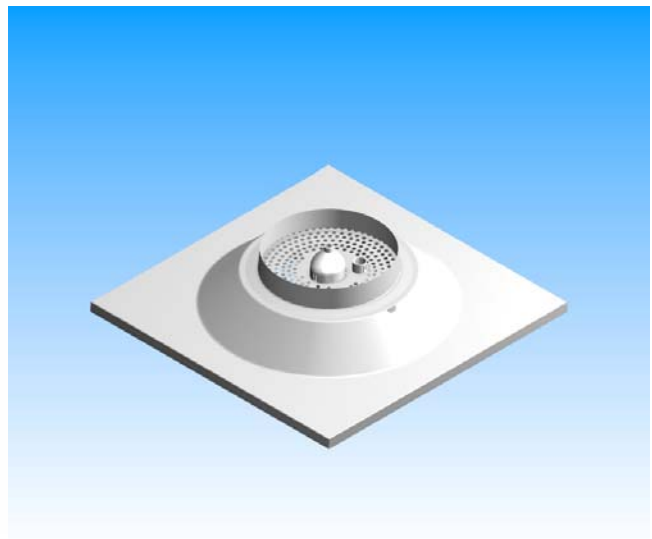
THE RICKARD VARI-DISC VAV DIFFUSER REVOLUTION



Never in the history of Variable Geometry VAV design has so much attention been given to the production of a Cost Effective, Architecturally Pleasing, Aerodynamic & Functionally Superior Variable Volume Diffusers as is now available from RICKARD. Consider the following advanced features & decide for yourself the superiority RICKARD brings to the HVAC industry with our new VCD, VSD & VRD diffusers:

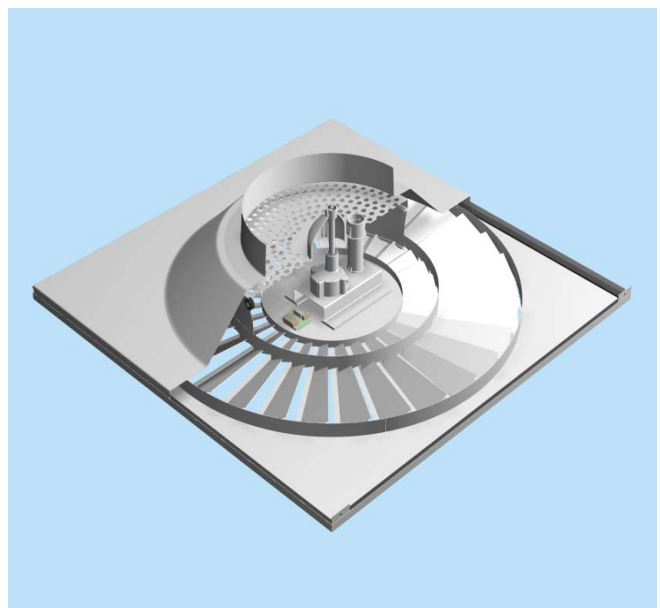
New Effective Aerodynamic Top Entry

- ◇ New improved swirled air diffusion.
- ◇ New one piece pressed steel top entry Backpan providing superior aerodynamically shaped components to reduce noise & improve air flow characteristics.
- ◇ Effective onboard temperature sensing
- ◇ Failsafe & fractureless support clips designed & developed.
- ◇ No visible support posts from within the airconditioned space.
- ◇ A variety of diffuser mounting options available.
- ◇ All control & power cabling concealed—not visible from below.
- ◇ Control & power cabling easily accessible from within ceiling void.
- ◇ Fully proportional zero voltage reheat control.
- ◇ Black-heat reheater mounted in separate collar providing the ease of installation in various positions & allowing remarkably simple heater retrofit.



New LinDrive2 Actuator

- ◇ New LinDrive2 actuator incorporating precise control disc positioning.
- ◇ VariDrive® actuator enables electronically adjustable maximum & minimum control disc stops on site.
- ◇ Aerodynamically shaped LinDrive2 actuator enclosure to reduce friction & noise.
- ◇ Interdependent induction tube & induction channel with central feature port for accurate onboard room temperature sensing.
- ◇ No access into ceiling void required to remove all internal diffuser components—simply twist 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 Thermo-Disc actuator for which UL certification has been secured.
- ◇ New LinDrive2 actuator power consumption is such that 15 diffusers with full control functions can be fed from a Single Power Module



INTRODUCTION

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 DESCRIPTION

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 constant 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 (or pneumatic) 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. 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 the 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, the sum of the horizontal & vertical travel of the air is equal to the diffuser throw. Throw remains essentially constant 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 ($\pm 10\text{Pa}$) 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, caution should be exercised when selecting diffusers outside the 40-80Pa. 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. 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.

GENERAL

CONTROLS

The VARI-DISC range of Variable Geometry diffusers are suitable for operation in conjunction with RICKARD standard (SSA), modular (MLM), Mini BMS & BMS compatible (Multi-loop) controls as well as those supplied by others. The RICKARD control range is able to provide you with a number of options including onboard or remote mounted temperature sensing, automatic cooling/heating change-over, proportional/integral reheat control, air flow sensing/monitoring, etc. For more detailed control information kindly refer to the RICKARD controls catalogue.

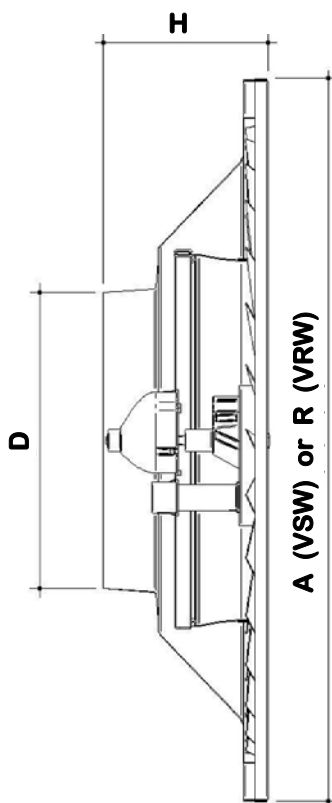
VARIABLE GEOMETRY SWIRLDIFFUSER PERFORMANCE VSW

NECK SIZE	READING	NECK TOTAL PRESSURE (Pa)				
		30	40	50	60	70
150	FLOW (l/s)	68	79	88	96	104
	THROW (m)	1.80	2.10	2.30	2.50	2.70
	NC LEVEL	26	29	31	33	35
200	FLOW (l/s)	112	130	145	159	172
	THROW (m)	2.20	2.50	2.8	3.10	3.30
	NC LEVEL	28	31	33	35	37
250	FLOW (l/s)	159	183	205	225	243
	THROW (m)	2.90	3.30	3.70	4.10	4.4
	NC LEVEL	29	33	35	37	39
300	FLOW (l/s)	194	224	250	274	296
	THROW (m)	2.90	3.30	3.70	4.10	4.40
	NC LEVEL	30	33	36	38	40

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 is 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.



DIMENSIONS (mm)				
NECK SIZE	∅ D	A	H	∅ R
150	150	595 x 595	137	580
200	200	595 x 595	137	580
250	250	595 x 595	137	580
300	293	595 x 595	137	580

SAMPLE SPECIFICATIONS

VARIABLE GEOMETRY VAV DIFFUSERS

(For Standard Stand-Alone Controls)

Supply and install Rickard VSW Variable Geometry VAV electronically controllable Swirl Diffusers where indicated on the project drawings. Each diffuser shall be fitted with a low voltage LinDrive2 actuator (12V DC) housed within an enclosure carried on the diffuser trim plate assembly which, in turn shall be supported from the diffuser backpan by a bayonet fitting.

The diffuser backpan shall be manufactured from deep draw quality pressed sheet steel incorporating an integral neck. The backpan, together with the diffuser swirl plate and control disc shall be degreased and chemically treated before being coated by means of a chip resistant fused epoxy powder.

(For Multi-Loop Modular Controls)

Supply and install Rickard VSW Variable Geometry VAV electronically controllable Swirl Diffusers where indicated on the project drawings. Each diffuser shall be fitted with a low voltage LinDrive2 actuator (12V DC) housed within an enclosure carried on the diffuser trim plate assembly which, in turn shall be supported from the diffuser backpan by a bayonet fitting.

The diffuser backpan shall be manufactured from deep draw quality pressed sheet steel incorporating an integral neck. The backpan, together with the diffuser swirl plate and control disc shall be degreased and chemically treated before being coated by means of a chip resistant fused epoxy powder.

An enclosure, secured to the reverse side of the diffuser backpan, shall house an electronic control interface PC board incorporating RJ type cable sockets and serving as a connection point for providing control signals to the diffuser actuator, adjacent slave diffuser and incoming control power.

ADDITIONLA INFORMATION

ELECTRIC HEATING

The RICKARD VSW Swirl 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 \pm 5 $^{\circ}$ C cut-out is fitted. A power-reset 85 \pm 5 $^{\circ}$ C overheat safety cutout may be fitted on request. 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 can offer an **Airflow Switch** to interrupt power to the re-heater controls when there is insufficient airflow across the heater element.

Heaters are available in various capacities, ranging from 0.5kW to 2.5kW. When calculating heater capacities for VAV diffusers, it must be borne in mind that heating in the cooling mode takes place when the diffuser is supplying minimum air flow and therefore care must be taken to ensure that an excessive temperature rise in the diffuser is avoided. Discharge temperatures in excess of than 32 $^{\circ}$ 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 $^{\circ}$ 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, a standard feature of the RICKARD **MLM**, **Mini BMS** and **Interoperable BMS Compatible Controls**.

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 .

MAXIMUM HEATER OUTPUT & CAPACITIES

Neck Total Pressure (Pa)	40	50	60	70	Fitted Heater Capacity (Watts)
Neck Diameter (mm)	Maximum Heater Output (Watts)				
150	230	250	280	300	500
200	480	530	580	620	750
250	660	740	810	880	1000
300	810	900	990	1070	1250

DIFFUSER PERFORMANCE WITH RE-HEATERS FITTED

NECK SIZE	READING	NECK TOTAL PRESSURE (Pa)				
		30	40	50	60	70
150	FLOW (l/s)	54	63	70	77	83
	THROW (m)	1.40	1.70	1.80	2.10	2.30
	NOISE LEVEL	-	25	27	29	31
200	FLOW (l/s)	112	130	145	159	172
	THROW (m)	2.20	2.50	2.80	3.10	3.30
	NOISE LEVEL	28	31	33	35	37
250	FLOW (l/s)	159	183	205	225	243
	THROW (m)	2.90	3.30	3.70	4.10	4.40
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	THROW (m)	2.90	3.30	3.70	4.10	4.40
	NOISE LEVEL	30	33	36	38	40

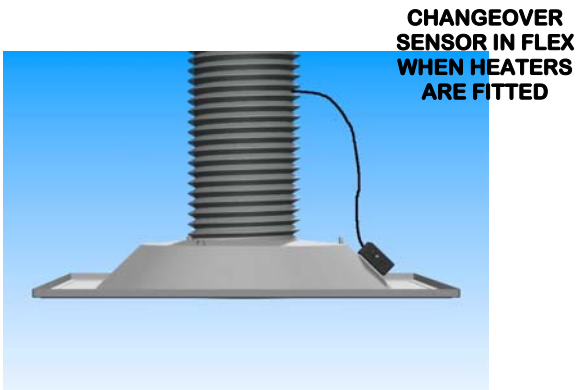
REVERSING CHANGEOVER

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 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 reinstated when the primary air temperature falls below room temperature.

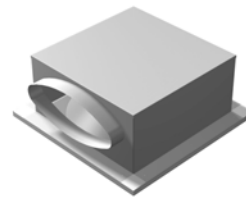
Should a VAV air diffusion unit be fitted with a re-heater, the heater will be proportionally energized between 0.5°C and 1.5°C below setpoint temperature, regardless of which mode the controller is in. Effectively, therefore, a re-heater will only be energized at *Minimum Supply Air Status* in the cooling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



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 being to ensure the lowest possible plenum height and 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 VSW diffuser with side entry plenums is 250 mm.



DIMENSIONS & MOUNTING METHODS

GENERAL

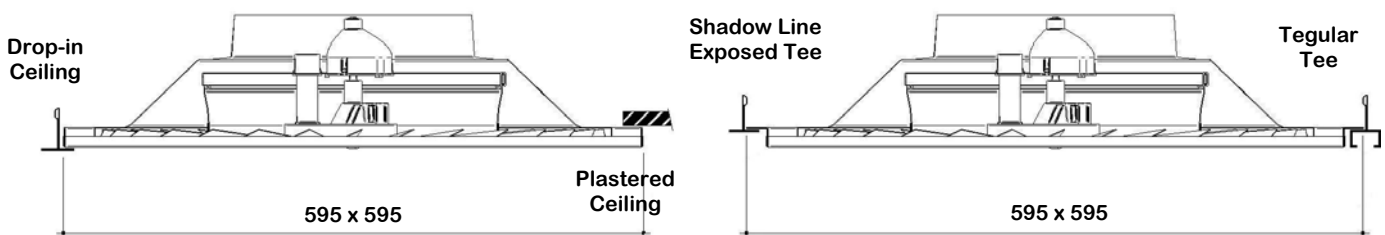
The basic VSW ceiling diffuser concept supports a wide range of diffusion unit styles. The basic diffuser usually drops into a square opening between ceiling tees, although ceiling openings need not be square and in fact, in the case of plastered ceilings, are often circular.

DIFFUSERS WITH SQUARE MOUNTING PLATES

These can be supplied with one size of mounting plate, namely 595mm x 595mm to suit various types of ceilings. 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 ceiling two methods of fixing may be used and should be specified if required. Concealed fixing is achieved by four fixing studs welded 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.



DIMENSIONS AND METHODS OF MOUNTING

CIRCULAR DIFFUSERS

Apart from the usual four-corner style, the RICKARD Swirl Diffuser is also available in a circular format—type VRW. 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. A circular “T” Bar frame is available for plastered ceiling mounting of the VRW range of diffusers.