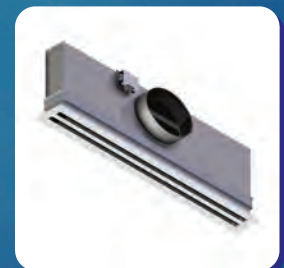
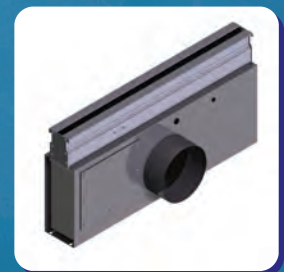


# ELECTRONIC VARIABLE VOLUME LINEAR DIFFUSER

4

## VLN 1

- 🌀 CONTROL THE PERIMETER EFFECTIVELY
- 🌀 HORIZONTAL/VERTICAL FLOW PATTERN
- 🌀 ONBOARD/REMOTE SENSING
- 🌀 EXCELLENT THROW & FLOW
- 🌀 HEATING AND COOLING CHANGEOVER
- 🌀 ENERGY EFFICIENT
- 🌀 NO MAINTENANCE
- 🌀 2 YEAR WARRANTY



## FEATURES

When a buildings thermal efficiency is paramount, the ideal solution to limit thermal losses or gains through its exterior is required. The Rickard Variable Volume Linear Diffuser (VLN) is the ideal solution to control a buildings internal perimeter zone. It creates a vertical curtain of conditioned air that acts as a barrier to the thermal load transmitted or lost through the building's exterior. By using innovative forced induction technology the VLN accurately senses the temperature and adjusts to precisely meet the demand. Aerodynamic pattern controllers inside the linear slot supply air quietly and efficiently and allow adjustment to direct the air horizontally or vertically.

Rickard VLN diffuser tracks are designed to be joined end-to-end to create uninterrupted lengths of attractive linear track.



## PERFORMANCE

Rickard VAV Diffusers control Room Temperature by adjusting the volume of air at the diffuser outlet. By changing the diffusers exit geometry, Coanda, Air Velocity and Throw is maintained at minimum and maximum volume. This technology prevents cold air from dumping at minimum, ensures excellent ventilation, air mixing, Air Change Effectiveness (ACE) and therefore thermal comfort (ADPI). Rickard VAV diffusers reduce pressure loss in the system due to their aerodynamic design and the absence of restrictions in the duct work.

## ENERGY SAVINGS

Green Building Benefits. Receive Management, Indoor Environmental Quality and Energy Efficiency Credits by using Rickard VAV Diffusers.

Rickard MLM controls use energy efficiently. Rickard MLM Diffusers use 2.4 VA (24VDC 100mA) only when the motor is running. MLM24 Power Supply Units use 40VA (220VAC 2A) or (115VAC 35A) max and can supply up to 15 diffusers. MLM Master Communications Units (MCU2 ) use 10VA (24VAC 4A) max and can connect to 60 diffusers.

## SENSING ACCURACY

Rickard Diffusers use innovative forced induction technology resulting in accurate room sensing and flexible zoning.

## CONTROLS

Master/Slave changes are achieved by installing an onboard controller that is activated using Rickard's Free Software. Electronically adjustable maximum and minimum damper limits allow designed air-flow volumes to be achieved. Global manual commands (all diffusers can be driven open) reduce commissioning costs. Cost effective standalone, LonWorks and BACnet BMS integration.

## CAPITAL & OPERATING COST

Low diffuser height can reduce a buildings overall cost by reducing the height of the ceiling void.

## INSTALLATION SAVINGS

Optional Jubilee Clamp saves time and material when attaching the flex.

## MAINTENANCE

Surface mount VLN diffusers working components and controls are all accessible from below the ceiling. No skilled labour or special tools are required. Diffuser life cycle testing gives peace of mind far beyond our two year warranty period (Electronic diffuser range). Life cycle testing is based on 3000 operating hours and 4000 control cycles per year and is the equivalent of 30years of service.

The VLN diffusers active section is constructed from corrosion resistant mill galvanized sheet steel and aluminium. The diffuser tracks are constructed from aluminium extrusion and are coated with epoxy powder coating.

No regular maintenance is required.

## AESTHETICS

The slim and attractive slot diffuser style provides a clean uninterrupted appearance that meets most architectural requirements.

## WARRANTY

Rickard offers a 2 year manufacturer's warranty on its Electronic VAV diffusers. Please see Terms and Conditions for a full description of our warranty.

## SAFETY

Working plastic components are moulded in glass reinforced Makrolon - Makrolon is flame retardant and chlorine and bromine free when burnt. The Rickard Thermo-Disc and Electronic actuators are moulded in Makrolon and are UL Certified.

## APPLICATION

### VAV COOLING AND HEATING

### VAV COOLING AND HEATING WITH TERMINAL REHEAT

When a buildings thermal efficiency is paramount, the ideal solution to limit thermal losses or gains through its exterior is required. The Rickard Variable Volume Linear Diffuser (VLN) is the ideal solution to control a buildings perimeter zone. It creates a vertical curtain of conditioned air that acts as a barrier to the thermal load transmitted or lost through the building's exterior. By using innovative forced induction technology the VLN accurately senses the temperature and adjusts to precisely meet the demand. Aerodynamic pattern controllers inside the linear slot supply air quietly and efficiently and allow adjustment to direct the air horizontally or vertically (single slot variant is only available in horizontal blow).

Rickard VLN diffuser tracks are designed to be joined end-to-end to create uninterrupted lengths of attractive linear track.

## OPERATION

Room temperature is intelligently controlled by varying the supply air volume in accordance with demand. The diffuser controller uses a proportional / integral response to achieve this. Volume control is achieved by opening or closing a set of slotted plates using our patented electric stepper motor, so as to vary the aperture through which the supply air passes. This provides true "VARIABLE GEOMETRY VAV" which effectively maintains air discharge velocity throughout the range of volume control from 100% down to as little as 25%.

Air is discharged in a linear vertical or horizontal pattern. Used in conjunction with our MLM controls, maximum and minimum supply air volumes may be adjusted to suit the particular design conditions.

A further useful feature of the RICKARD VLN is the ease with which the direction of airflow may be adjusted. Although airflow direction is not normally changed once the system is operational, it does simplify the ordering procedure. All linear air diffusion track is identical and the choice of one-way (horizontal or vertical) or two-way blow (horizontal) is easily adjusted by simply flipping the flow directional vane to the preferred side.

It is possible to direct air vertically downwards for better room penetration, especially when the VLN is in the heating mode.

## SELECTION

The first consideration when designing a system is to calculate the required supply air volume and 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 and 7.5m/s (650 and 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 and the internal volume control damper is in the fully open position. Coning occurs when two airstreams travelling in opposite directions meet and 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 and 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 and 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 and 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 and the diffuser depends on the length and 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 and can be explained briefly as follows:

The static pressure loss due to friction in the flexible duct ( $\pm 10\text{Pa}$  or  $0.04\text{ins wg}$ ) would normally be about the same as the velocity pressure in the neck of the diffuser and since total pressure is the sum of static and 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  $30\text{-}70\text{Pa}$  ( $0.12\text{-}0.28\text{ins Wg}$ ), caution should be exercised when selecting diffusers outside the  $40\text{-}80\text{Pa}$  ( $0.8\text{-}0.32\text{ins Wg}$ ). At lower pressures air movement and induction may be insufficient and at higher pressures draughts and excessive noise may result. Best results are obtained when diffusers are selected at pressures of  $40\text{-}60\text{Pa}$  ( $0.08\text{-}0.24\text{ins Wg}$ ). 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 and 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 restrictions 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 causing over-cooling/heating and increased noise.

## TYPES

### TRACK SLOT TYPES

VLN Linear Diffusers are available with 1-4 slot tracks.



### TRACK LENGTHS

The standard VLN is available in unit lengths of:

- 600mm
- 900mm
- 1200mm
- 1500mm

### TRACK TYPES

VLN Linear Tracks are designed to fit **Plastered Ceilings (Surface Mount)** and most **Ceiling Grid (Drop-in)** variants.

Rickard VLN Diffuser tracks are designed to be joined end-to-end with alignment pins to create uninterrupted lengths of attractive linear track. VLN Tracks are compatible with other Rickard VLN tracks, Dummy tracks (inactive sections of track often used for return air) or CLN tracks (Constant Volume Linear Diffusers).

VLN Linear Diffusers are available with 1 - 4 Slot tracks. 2 to 4 slot variants are available with adjustable pattern controllers (vertical to horizontal), single slot tracks are available with a horizontal blow pattern controller as standard.

VLN Linear Tracks are designed to fit Plastered Ceilings (Surface Mount) and most Ceiling Grid (Drop-in) variants.

Rickard VLN Diffuser tracks are designed to be joined end-to-end to create uninterrupted lengths of attractive linear track. VLN Tracks are compatible with other Rickard VLN tracks, Dummy tracks (inactive sections of track often used for return air) or CLN tracks (Constant Volume Linear Diffusers).

Tracks are finished in a wide range of high quality epoxy powder coated finishes. Matt White comes as standard.

#### ***SPIGOT SIZE AND QUANTITY***

VLN Linear Diffusers with multiple slots require larger and/or more spigots. Please see the VLN Spigot Detail table for more detail.

<b>VLN1 SPIGOT DETAILS (mm)</b>				
<b>No. of SLOTS</b>	<b>VLN1 600</b>	<b>VLN1 900</b>	<b>VLN1 1200</b>	<b>VLN1 1500</b>
<b>1</b>	150	200	250	300
<b>2</b>	150	200	250	300
<b>3</b>	200	250	2x200	2x250
<b>4</b>	250	2 x 200	2 x 250	2 x 300

#### ***SENSING OPTIONS***

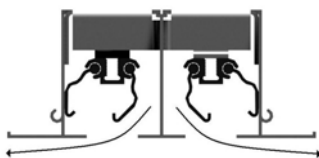
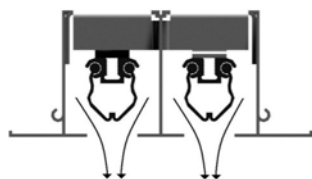
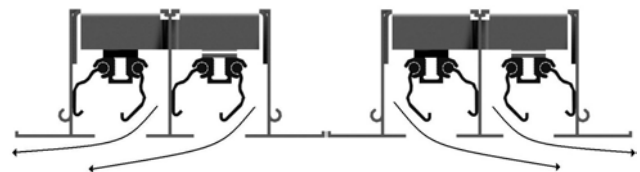
- **Masters** (fitted with an onboard sensor and controller)
- **Master ready Slaves** (fitted with an onboard sensor but without an onboard controller)
- **Slaves** (to follow a Master Diffuser or be converted to a Remote Master with a Remote Wall Thermostat)

<b>VLN1 600 - 150mm</b>	<b>FULLY OPEN</b>				
NECK TOTAL PRESSURE (Pa)	30	40	50	60	70
1 SLOT, FIXED HORIZONTAL BLOW (19mm each)					
FLOW (l/s)	18	22	26	29	32
THROW (m)	5.34	6.21	7.82	9.09	9.41
2 SLOT, ADJUSTABLE BLOW (19mm each)					
FLOW (l/s) PATTERN A	41	48	53	59	64
FLOW (l/s) PATTERN B	54	62	69	76	82
FLOW (l/s) PATTERN C	41	48	53	59	64
THROW (m) PATTERN A	4.5	4.8	5.1	5.4	5.6
THROW (m) PATTERN B	3.2	3.4	3.6	3.8	3.9
THROW (m) PATTERN C	6.4	6.9	7.3	7.6	7.9
NOISE - NC LEVEL	30	33	35	37	39

<b>VLN1 900 - 200mm</b>	<b>FULLY OPEN</b>				
NECK TOTAL PRESSURE (Pa)	30	40	50	60	70
1 SLOT, FIXED HORIZONTAL BLOW (19mm each)					
FLOW (l/s)	30	37	43	48	53
THROW (m)	5.21	6.84	8.37	9.82	11.18
2 SLOT, ADJUSTABLE BLOW (19mm each)					
FLOW (l/s) PATTERN A	71	82	92	99	108
FLOW (l/s) PATTERN B	85	98	109	120	129
FLOW (l/s) PATTERN C	71	82	92	99	108
THROW (m) PATTERN A	5.5	5.9	6.3	6.6	6.8
THROW (m) PATTERN B	3.9	4.2	4.4	4.6	4.8
THROW (m) PATTERN C	7.8	8.4	8.9	9.3	9.7
NOISE - NC LEVEL	32	35	37	39	41

<b>VLN1 1200 - 250mm</b>	<b>FULLY OPEN</b>				
NECK TOTAL PRESSURE (Pa)	30	40	50	60	70
1 SLOT, FIXED HORIZONTAL BLOW (19mm each)					
FLOW (l/s)	44	54	63	70	77
THROW (m)	4.58	5.45	6.02	6.58	7.31
2 SLOT, ADJUSTABLE BLOW (19mm each)					
FLOW (l/s) PATTERN A	96	111	124	135	146
FLOW (l/s) PATTERN B	118	137	153	168	181
FLOW (l/s) PATTERN C	96	111	124	135	146
THROW (m) PATTERN A	6.4	6.9	7.3	7.6	7.9
THROW (m) PATTERN B	4.5	4.8	5.1	5.4	5.6
THROW (m) PATTERN C	9	9.7	10.3	10.7	11.2
NOISE - NC LEVEL	33	36	38	40	42

<b>VLN1 1500 - 300mm</b>	<b>FULLY OPEN</b>				
NECK TOTAL PRESSURE (Pa)	30	40	50	60	70
1 SLOT, FIXED HORIZONTAL BLOW (19mm each)					
FLOW (l/s)	53	65	75	84	90
THROW (m)	4.77	5.61	6.16	6.75	7.47
2 SLOT, ADJUSTABLE BLOW (19mm each)					
FLOW (l/s) PATTERN A	118	136	151	166	179
FLOW (l/s) PATTERN B	155	179	199	218	236
FLOW (l/s) PATTERN C	118	136	151	166	179
THROW (m) PATTERN A	7.1	7.7	8.1	8.5	8.8
THROW (m) PATTERN B	5	5.4	5.7	6	6.2
THROW (m) PATTERN C	10	10.8	11.5	12	12.5
NOISE - NC LEVEL	34	37	39	41	43


**THROW PATTERN A**

**THROW PATTERN B**

**THROW PATTERN C**

Throw data is taken 25mm below the ceiling on a line through the centre of the diffuser with the damper 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:2 x 10<sup>-5</sup> Pa) and Sound Power Level (dBW re: 10<sup>-12</sup> watts) 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.

Performance Data applies to Standard Air having a density of 1.2 kg/m<sup>3</sup>.

**OPTIONS**

The Rickard Linear Diffuser Range supports the following diffusion unit styles.

**EXPOSED TEE CEILING GRID**

1. DROP-IN MOUNTING

The Drop-in linear diffuser is designed to lay-in a standard ceiling grid. The linear track has a flange along its length to hide the ceiling boards edge from below. The Drop-in linear diffuser has flat ends to fit neatly inside the tees. Rickard recommends additional support to give the diffuser additional stability and support. Attach wire or threaded rod between the ceiling and the support holes provided in the top of the diffusers plenum. Linear diffusers of 595 and 1195mm are available to fit 600 and 1200mm ceiling grids respectively.

2. MAINTENANCE OF ELECTRONIC DROP-IN LINEAR DIFFUSERS

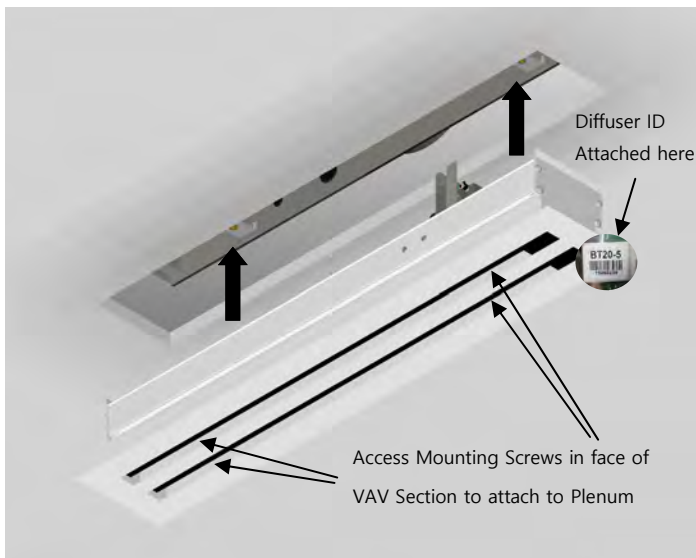
The diffusers controls and actuator are easily accessible from inside the ceiling. All the controls, namely the Interface box and the diffuser controllers are mounted outside the plenum. The Interface box allows diffuser to diffuser connections and the diffuser and onboard controller are mounted together in a clear plastic box to allow easy access. The diffusers actuator is accessible through an access panel on the side of the plenum.

**PLASTERED CEILING**

1. SURFACE MOUNTING

a. Individual Surface Mounting

The Surface mount linear diffuser is designed to fit a plastered ceiling from below. The linear track has a flange along its length and end to hide the rough cut edges of plastered ceiling.

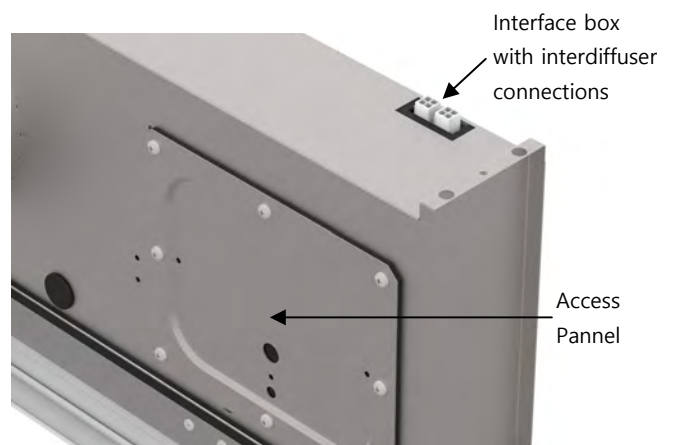
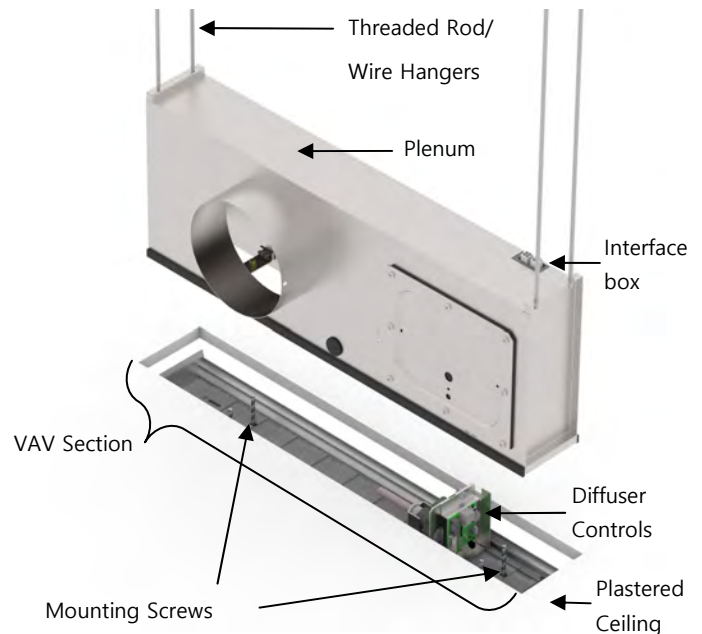


b. Butt-joined Surface Mounting

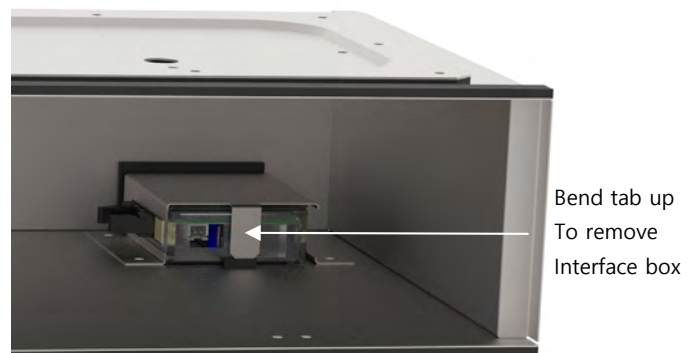
Surface mount linear diffusers can be joined together with other VAV linear diffusers, CAV linear diffuser or inactive track to provide long lengths of uninterrupted linear track. VAV linear diffusers, CAV linear diffuser or inactive track that are to be butt joined should be ordered without angle end borders (the flange on the end of the track). Sey-lock pins will be provided with every diffuser to join the tracks together. Special VAV, CAV or inactive track lengths are available on request.

2. MAINTENANCE OF ELECTRONIC SURFACE MOUNT LINEAR DIFFUSERS

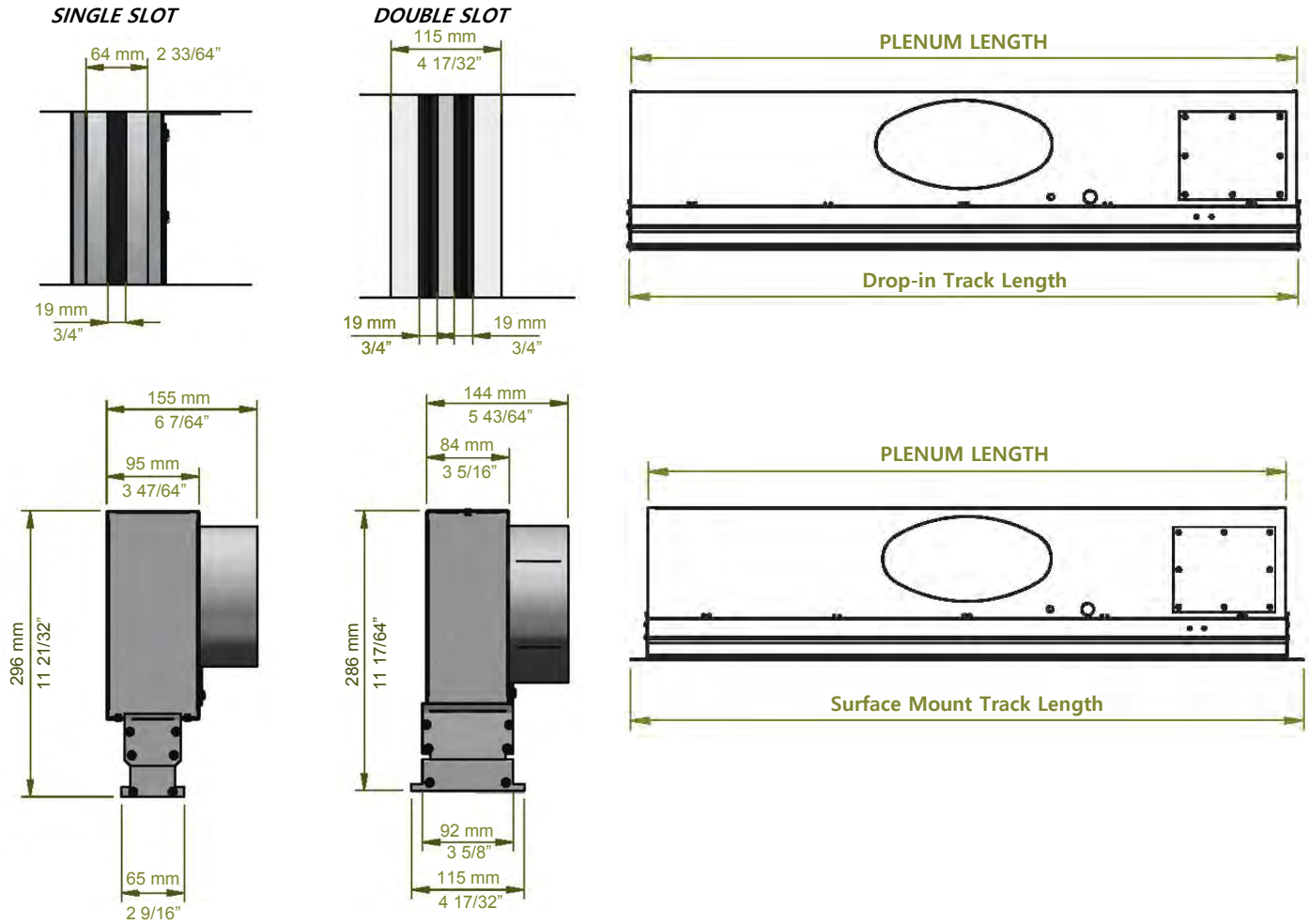
The diffusers controls and actuator are easily accessible from below the ceiling. The Interface box that allows diffuser to diffuser connections is mounted inside the diffuser plenum with inter-diffuser connections accessible from the outside. The diffuser controller, onboard controller and actuator are mounted on the active section of the diffuser. The active section is removable from below the ceiling. Mounting screws, accessible from the track face connect the active section to the diffuser plenum. Once the active section is unscrewed from the plenum, the entire active section can be removed from the ceiling by unplugging the ribbon cable that connect the Interface and diffuser controller. The diffuser and onboard controller are mounted together in a clear plastic box to allow easy access.



**View of Interface Box Inside Plenum**



**VLN1 GENERAL DIMENSIONS**



VLN1 GENERAL DIMENSIONS - for Metric Markets (mm)								
Nominal Length	Plenum Length	Track Length Single/Double Slot Butt-Join Mounting	Track Length Single/Double Slot Drop-In Mounting (T-Bar Ceiling)	T-Bar Ceiling Centres	Track Length Single Slot Surface Mounting (Plastered Ceiling)	Track Length Double Slot Surface Mounting (Plastered Ceiling)	Ceiling Cut-Out Length Single/Double Slot Surface Mounting (Plastered Ceiling)	Spigot Size $\varnothing$
600	590	590	595	600	656	656	600	150
900	890	890	895	900	956	956	900	200
1200	1190	1190	1195	1200	1256	1256	1200	250
1500	1490	1490	1495	1500	1556	1556	1500	300

VLN1 GENERAL DIMENSIONS - for US Customary Markets (inches)								
Nominal Length	Plenum Length	Track Length Single/Double Slot Butt-Join Mounting	Track Length Single/Double Slot Drop-In Mounting (T-Bar Ceiling)	T-Bar Ceiling Centres	Track Length Single Slot Surface Mounting (Plastered Ceiling)	Track Length Double Slot Surface Mounting (Plastered Ceiling)	Ceiling Cut-Out Length Single/Double Slot Surface Mounting (Plastered Ceiling)	Spigot Size $\varnothing$
24	23 15/64	23 15/64	23 3/4	24	25 53/64	25 53/64	24	6
36	35 3/64	35 3/64	35 3/4	36	37 41/64	37 41/64	36	8
48	46 27/32	46 27/32	47 3/4	48	49 29/64	49 29/64	48	10
60	58 21/32	58 21/32	59 3/4	60	61 17/64	61 17/64	60	12

## GENERAL

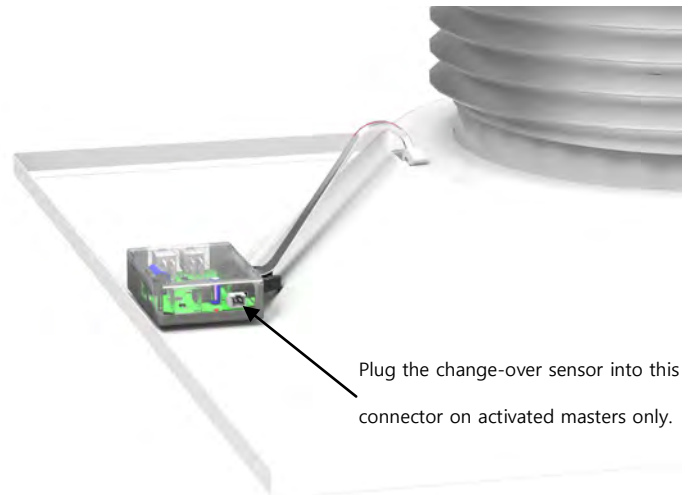
The RICKARD Reversing Changeover facility ensures that the VAV diffuser controls the temperature accurately when the central system is supplying either warm or cold air.

## OPERATION

When the system switches from cooling to heating, 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.

## INSTALLATION

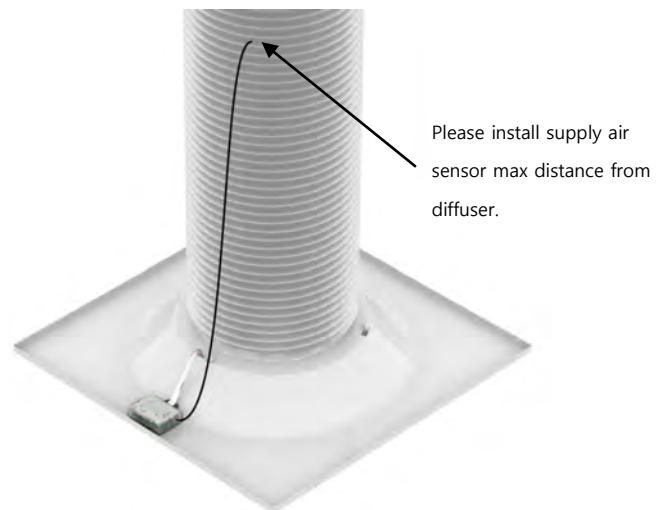
Converting a standard RICKARD master diffuser to incorporate changeover functionality is as simple as plugging in the supply air/changeover temperature sensor and activating it using the software. Every master controller is pre-activated. This temperature sensor must be fitted in such a way that it senses the primary air temperature being supplied to the diffuser.



Plug the change-over sensor into this connector on activated masters only.

VCD1 Shown. Use the same connector on other models.

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. Every changeover sensor is labeled "Please install supply air sensor max distance from diffuser" to ensure this.



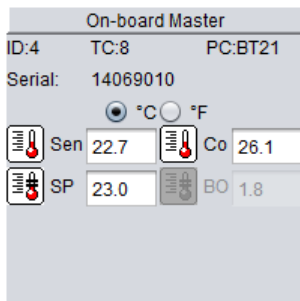
Please install supply air sensor max distance from diffuser.

VCD1 Shown. Always locate sensor away from heater when fitting to other models.

The controller compares the primary air and room temperature. Whenever the supply air temperature exceeds the room temperature by one degree Celsius, the control action is reversed and switches to heating mode. Cooling mode is re-instated when the primary air temperature falls one degree Celsius below room temperature.

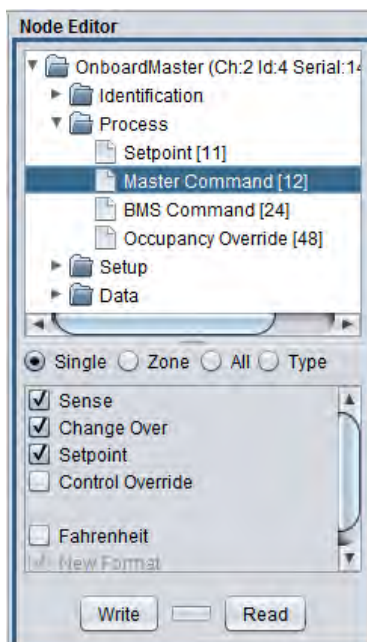
## ENERGY EFFICIENCY

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 set-point temperature, regardless of which mode the controller is in. Effectively, 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 extremely energy efficient from a Green Building perspective.



## TYPICAL MASTER SETTINGS

Change-over sensing, room sensing and set-point is activated.

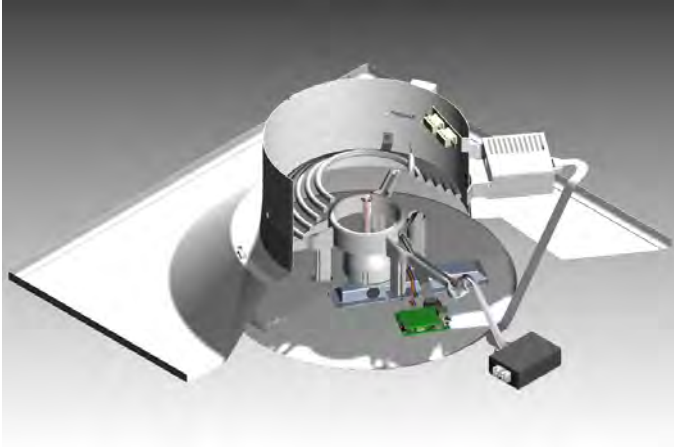


**NOTE:** Slave diffusers receive a control signal from the master diffuser and therefore do not require nor should they be fitted with a changeover sensor. It is also important that a slaves changeover sensing is turned off on the MLM application. Failure to do so will result in a zone not operating correctly. Only one changeover sensor should be activated per zone i.e. the master.



**FORM FACTOR**

RICKARD ceiling diffusers may be fitted with electric re-heaters that are housed within a sleeve which slides into the diffuser neck. This applies to ceiling diffuser types VCD1, VSD1, CCD3, CSD3, VSW1 and CSW3's. The heaters are energised when additional heating is required in a room. Heaters fitted into WBD's and VLN's are not modular and are fitted to the diffusers casing or spigot respectively.



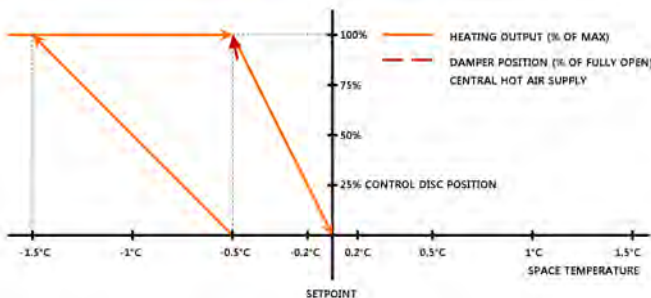
**VAV PLATE DIFFUSER FITTED WITH MODULAR HEATER SPIGOT**



**WBD WITH DEDICATED HEATER FITTED**

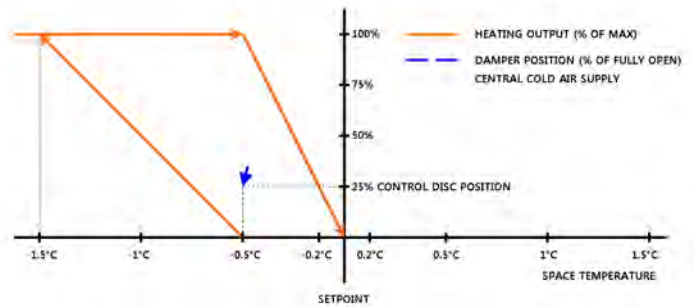
If used correctly, electric heating in VAV diffusers can be considered to be an energy saving device. By using them in offices that are typically colder than the building average allows the central plant to produce less heating in winter than is otherwise possible.

The most efficient scenario in heating is for the central plant to supply sufficient heated air to allow most of the zones to be in control when the diffusers damper is close to minimum position. Zones that are colder are controlled by the diffuser opening further. Zones that cannot be satisfied by the diffuser supplying warm air at full volume are topped up with supplementary heating.



The most efficient scenario in cooling is for the central plant to supply sufficient cool air to allow most of the zones to be in control when the diffuser dampers are close to minimum position. Zones that are warmer can be controlled by the diffuser opening further. Zones that cannot be warmed sufficiently by reducing the cold air supply can be controlled by heating this reduced volume of air.

If the room temperature were to fall by 0.5°C below set point, the Triac Controller will commence energizing the heater proportionally and will fully energize the heater when the room temperature is approximately 1.5°C below set point.



Integration of the Rickard VAV diffuser system with the central plant BMS is possible by using our MLM Interoperable BMS Compatible Controls.

**PROPORTIONAL HEATING**

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

**CONTROLS**

In a situation where multiple diffusers are controlled from a single controller, each diffuser will be fitted with its own triac 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 Recommended Heater Output (Watts)", 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 or MLM 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 air flow was 30% of maximum with 17°C air temperature rise, the heater output for a VCD 250 should be set to 1350 watts. Kindly refer to the help section in the MLM software program for more detailed information.

**IMPORTANT ELECTRICAL INFORMATION:** Electrical reticulation should be designed to have the capacity to manage the heaters full capacity e.g. when a heater is set to 50%, the heater element draws the same current as it would when set to 100% but it is drawn for 50% of the time.

**SELECTION GUIDELINES**

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 appropriate products table giving the "Maximum Recommended Heater Output (Watts)" on page 3 for each diffuser 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 are set electronically for an air temperature rise of no more than 17°C, a standard feature of the RICKARD MLM and Interoperable BMS Compatible Controls.

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

**ELECTRICAL AND OVERHEAT SAFETIES**

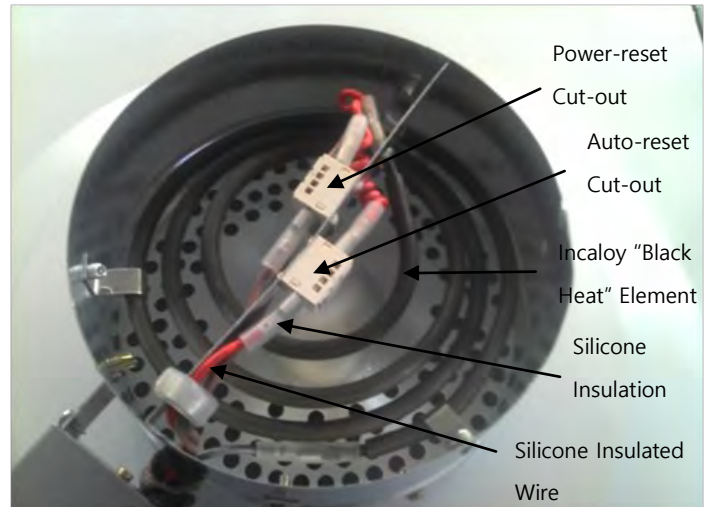
Every Heater Module is fitted with a coiled Electrical Element inside a Mill Galvanised Sheet metal enclosure. The Heater Elements are "black heat" having a heat density of 3.2W/cm<sup>2</sup> and are constructed from an Incoloy material that does not glow red when energised. This element is selected to reduce the risk of combustible materials igniting should they come into contact with the heater element itself. No combustible materials are used in the construction of a Rickard Diffuser or Heater Module. Rickard uses a high spec flame retardant, self extinguishing polycarbonate plastic that is chlorine and bromine free and has a UL94 V-0 rating at 1.5mm in its ceiling diffusers. The Heater modules are fitted with their own Triac or Heater driver and receive a proportional signal from the diffuser controls when additional heating is required to bring the room into control. The Triac receives its power from a separate power circuit. Dedicated plug tops can be fitted to the heater module on request.

The Heater Modules Triacs are fitted with a number of safeties to reduce the risk of failure. The Triac is fitted inside an electrically grounded metal enclosure that is physically attached to the Heater module Enclosure. This safety increases the electrical safety of the device should a short circuit occur. A fuse offers additional protection against large current surges and shorts. A Transient suppressor prevents the Triac from failing closed and therefore driving the heater permanently after a voltage surge has occurred.

In all cases an auto-reset 65°±5°C (10 000 cycles) and power-reset 85°C±5°C (300 cycles) overheat safety cut-out is fitted as standard. The reset temperatures indicate the air temperature inside the over-heat safety cut-out casing at which it operates. Rickard heater modules are designed so that the overheat safety cut-outs trigger when the neck Total pressure is 30Pa or below. The trigger point can vary depending on a number of factors namely, excessively squashed or bent flex, neck size, heater size and damper position. Rickard controls do not activate its heaters below 20% flow damper position, thereby reducing the likelihood of the overheat safeties not triggering in the range described. The power reset cut-out is reset by turning the power supply off momentarily. If a power reset is required, an investigation into the cause should be made. Push-button type manual reset safeties are not recommended in conjunction with diffuser re-heaters.

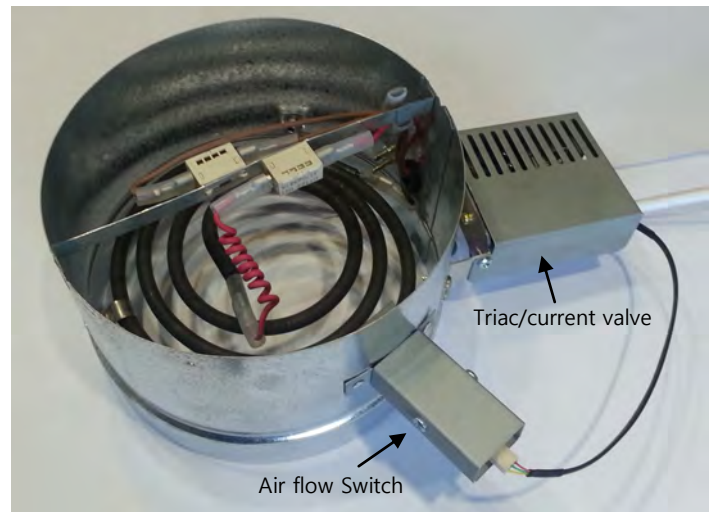
**STANDARD SAFETIES FITTED TO ALL VAV DIFFUSER TYPES**

*(VCD1, VSD1, CCD3, CSD3, VSW1, WBD's and VLN's )*



For additional safety, RICKARD offer an Airflow Switch to interrupt power to the re-heater controls when there is insufficient airflow across the heater element. The switch is calibrated to disable the heater current valve below a static pressure of 12Pa (+/- 5Pa). The switch operates as a dead man switch i.e. if the cable between the switch and the heater controls is unplugged, the heater will not operate.

**OPTIONAL AIRFLOW CUT-OUT/SWITCH**



**TESTING**

All electrical wiring associated with the re-heater is carried out in the factory and all units carefully tested for correct operation.

**OPTIONS**

Heaters are available in various capacities, ranging from 0.5kW to 2.5kW.

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

Recommended Heater settings & sizing for a 15 Degree C Heat Rise @ 30% Open																			
VCD	Pa	20			30			40			50			60			70		
	Neck Size (mm)	kW			kW			kW			kW			kW			kW		
		Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set
	150	0.35	0.50	70%	0.34	0.50	68%	0.50	0.50	100%	0.50	0.50	100%	0.60	0.75	80%	0.65	0.75	87%
	200	0.60	0.75	80%	0.70	0.75	93%	0.75	0.75	100%	0.90	1.00	90%	1.00	1.00	100%	1.00	1.00	100%
	250	0.85	1.00	85%	1.00	1.00	100%	1.15	1.25	92%	1.30	1.50	87%	1.40	1.50	93%	1.50	1.50	100%
	300	1.00	1.00	100%	1.25	1.25	100%	1.50	1.50	100%	1.65	2.00	83%	1.75	2.00	88%	2.00	2.00	100%
	350	1.30	1.50	87%	1.50	1.50	100%	1.85	2.00	93%	1.85	2.00	93%	2.25	2.50	90%	2.50	2.50	100%

Recommended Heater settings & sizing for a 15 Degree C Heat Rise @ 30% Open																			
VSW	Pa	30			40			50			60			70					
	Neck Size (mm)	kW			kW			kW			kW			kW					
		Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set			
	150	0,35	0,5	70%	0,4	0,5	80%	0,45	0,5	90%	0,5	0,5	100%	0,55	0,75	73%			
	200	0,6	0,75	80%	0,7	0,75	93%	0,8	1	80%	0,85	1	85%	0,9	1	90%			
	250	0,85	1	85%	1	1,25	80%	1,1	1,5	73%	1,2	1,25	96%	1,3	1,5	87%			
	300	1	1	100%	1,2	1,5	80%	1,35	1,5	90%	1,5	1,5	100%	1,6	2	80%			

Recommended Heater settings & sizing for a 15 Degree C Heat Rise @ 30% Open																			
VLN1 2 Slot Pattern C	Pa	30			40			50			60			70					
	Length (mm)	kW			kW			kW			kW			kW					
		Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set			
	600	0,3	0,5	60%	0,35	0,5	70%	0,35	0,5	70%	0,4	0,5	80%	0,45	0,5	90%			
	900	0,45	0,5	90%	0,55	0,55	100%	0,6	0,75	80%	0,65	0,75	87%	0,7	0,75	93%			
	1200	0,65	0,75	87%	0,75	0,75	100%	0,8	1	80%	0,9	0,9	100%	1	1	100%			
	1500	0,85	0,85	100%	1	1	100%	1,1	1,25	88%	1,2	1,2	100%	1,3	1,5	87%			

Recommended Heater settings & sizing for a 15 Degree C Heat Rise @ 30% Open																			
WBD	Pa	20			30			40			50								
	Size (mm)	kW			kW			kW			kW								
		Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set						
	300/100	0,4	0,5	80%	0,5	0,5	100%	0,55	0,75	73%	0,6	0,75	80%						
	350/100	0,55	0,75	73%	0,65	0,75	87%	0,7	0,75	93%	0,75	0,75	100%						
	400/100	0,6	0,75	80%	0,75	0,75	100%	0,8	1	80%	0,9	1	90%						
	450/100	0,7	0,75	93%	0,8	1	80%	0,9	1	90%	1	1	100%						
	500/100	0,7	0,75	93%	0,85	1	85%	0,95	1	95%	1,1	1,25	88%						
	550/100	0,75	0,75	100%	0,95	1	95%	1,1	1,25	88%	1,2	1,25	96%						
	600/100	0,9	1	90%	1	1	100%	1,2	1,25	96%	1,25	1,25	100%						
	650/100	0,95	1	95%	1,15	1,25	92%	1,25	1,25	100%	1,45	1,5	97%						
	500/150	1	1	100%	1,25	1,25	100%	1,6	2	80%	1,8	2	90%						
	550/150	1,2	1,25	96%	1,4	1,5	93%	1,65	2	83%	1,85	2	93%						
	600/150	1,4	1,5	93%	1,6	2	80%	1,9	2	95%	2	2	100%						
	650/150	1,4	1,5	93%	1,7	2	85%	2	2	100%	2,2	2,5	88%						
	700/150	1,5	1,5	100%	1,85	2	93%	2,2	2,5	88%	2,4	2,5	96%						
	800/150	1,75	2	88%	2,1	2,5	84%	2,5	2,5	100%	2,5	2,5	100%						

Recommended Heater settings & sizing for a 10 Degree C Heat Rise @ 100% Open																			
CCD	Pa	20			30			40			50			60			70		
	Neck Size	kW			kW			kW			kW			kW					
		Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set			
	150	1.30	1.50	87%	1.50	1.50	60%	1.75	2.00	88%	2.00	2.00	100%	2.25	2.50	90%	2.40	2.50	96%
	200	1.80	2.00	90%	2.25	2.50	90%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%
	250	2.30	2.50	92%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%
	300	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%

Recommended Heater settings & sizing for a 10 Degree C Heat Rise @ 100% Open																			
CSW	Pa	20			30			40			50			60			70		
	Neck Size	kW			kW			kW			kW			kW					
		Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set	Adjust	Fit	Set			
	150	0.70	0.75	93%	0.80	1.00	80%	1.00	1.00	100%	1.00	1.00	100%	1.15	1.25	92%	1.25	1.25	100%
	200	1.20	1.25	96%	1.30	1.50	87%	1.50	1.50	100%	1.75	2.00	88%	1.90	2.00	95%	2.00	2.00	100%
	250	1.80	2.00	90%	2.00	2.00	100%	2.25	2.50	90%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%
	300	2.00	2.00	100%	2.40	2.50	96%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%	2.50	2.50	100%

To limit stratification in heating Rickard recommends that the heater outputs be limited to the values published in the tables above. The calculated values will ensure that the heat rise is no more than 15°C in VAV diffusers and 10°C in CAV diffusers. Please note that these values are a guide and are calculated at 30% volume for VAV diffusers and 100% volume for CAV diffusers. By adjusting the diffuser damper position down, a smaller volume will create a larger heat rise and therefore increase the likelihood of stratification. The Fit column indicates the maximum fitted heater size recommended, the Adjust value indicates the maximum heater setting recommended to achieve a 15°C (VAV) or 10°C (CAV) heat rise and the Set column is the MLM Heater Output % value required to achieve a 15°C (VAV) or 10°C (CAV) heat rise.