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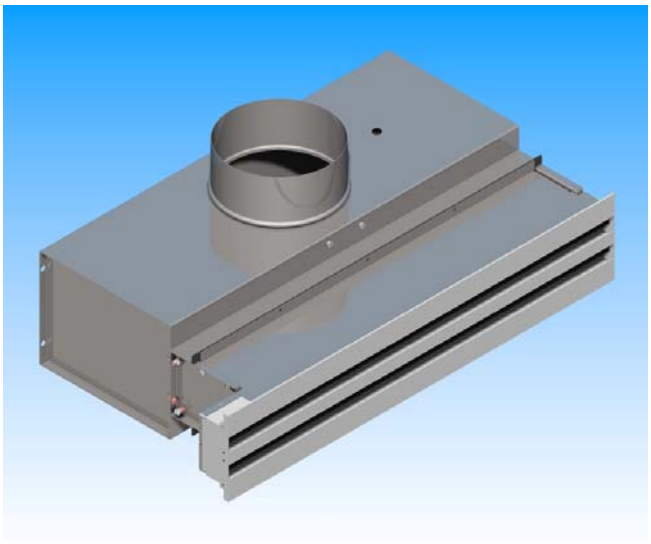
RICKARD

INTELLIGENT COMFORT CONTROL

ELECTRONIC VARIABLE GEOMETRY VAV LINEAR CEILING DIFFUSERS



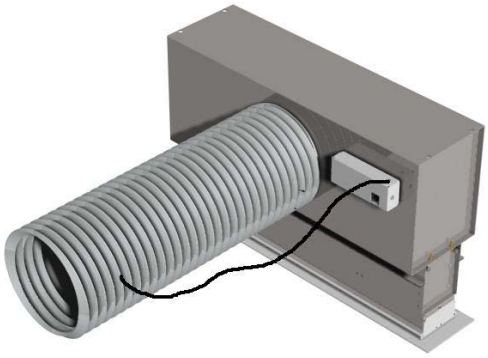
VLN 1

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



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INTRODUCTION

The **RICKARD VARIABLE GEOMETRY LINEAR VAV TERMINAL UNIT** (Type VLN) provides an especially ideal means of distributing conditioned air into perimeter zones of a building, where the temperature control requirements are the most demanding. The slim and attractive shape of the linear diffuser extrusions ensures that the unit blends into any ceiling design and meets almost all architectural requirements. At the same time the superior aerodynamic design ensures that air distribution without any drafts, is quiet and efficient.

SPECIAL FEATURES

The Rickard VLN boasts a few novel features not generally found on other similar products. The air flow pattern is adjustable from below the ceiling, being changeable from two-way blow to one-way blow in either direction or even to vertical down blow. A second useful option is that the VLN linear diffusers extrusions are designed to be fitted end-to-end with alignment pins such they are perfectly straight within a ceiling, providing a continuous architecturally pleasing appearance. Under these circumstances, as the active VLN terminal units will only take up a portion of the total length of linear diffuser track, the intermediate unused sections may be utilized for return air purposes thereby alleviating the need for additional return grilles or louvers.

OPERATION

GENERAL DESCRIPTION

Room temperature is controlled by varying the supply air volume in accordance with demand. Volume control is achieved by opening and close a set of aerodynamically designed, extrude aluminium vanes using our unique **LinDrive2** electric or pneumatic actuator, so as to vary the apperture through which the supply air passes at the point of exit from the diffuser. This provides for true "VARIABLE GEOMETRY VAV" which effectively maintains air discharge velocity throughout the range of volume control from 100% down to as little as 25%.

The standard VLN linear diffusion units are available with two active slots to match active terminal unit lengths of 600mm, 900mm, 1200mm and 1500mm. The linear diffusion track has been engineered for butting together with hairline precision so that an unlimited length of continuous diffuser is possible without sacrificing the attractive appearance. In this case the active VLN terminal units may be randomly placed anywhere along the length of diffusion track to suit virtually any building partion layout.

The active VLN terminal unit is constructed using corrosion resistant mill galvanized sheet steel, while the linear diffuser aluminium extrusions are epoxy powder coated in a variety of colours or natural anodized aluminium.

AIRFLOW SELECTION

A further useful feature of the RICKARD VLN is the ease with which the direction of airflow may be adjsuted. 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 or two-way blow is easily implemented on site by simply flipping the flow directional vanes to the prefered side. For abnormally high ceilings, it is possible to direct air vertically downwards for better room penetration, especially when the VLN is in the heating mode.

MAINTAINENCE

As with all other RICKARD AIR DIFFUSION products, the VLN requires no routine preventative maintenance.

TERMINAL 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 3.5m/s & 7.5m/s.

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 when measured 25mm 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 that the of 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 (±10Pa) 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 approximately numerically the same as duct static pressure. Although the tables reflect diffuser performance for neck total pressures ranging from 20Pa to 100Pa, caution should be exorcised when selecting diffusers outside the 40Pa to 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 between 50Pa and 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.

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THE VLN VARIABLE GEOMTRY LINEAR VAV TERMINAL UNIT PERFORMANCE

VLN 6001 - NECK DIAMETER 150mm FULLY OPEN

NECK TOTAL PRESSURE (Pa)	30	40	50	60	70
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

VLN 9001 - NECK DIAMETER 200mm FULLY OPEN

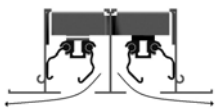
NECK TOTAL PRESSURE (Pa)	30	40	50	60	70
FLOW (l/s) PATTERN A	71	82	92	99	108
FLOW (l/s) PATTERN B	85	98	109	120	129
FLOW (l/s) PATTERN C	71	82	92	99	108
THROW (m) PATTERN A	5.5	5.9	6.3	6.6	6.8
THROW (m) PATTERN B	3.9	4.2	4.4	4.6	4.8
THROW (m) PATTERN C	7.8	8.4	8.9	9.3	9.7
NOISE - NC LEVEL	32	35	37	39	41

VLN 12001 - NECK DIAMETER 250mm FULLY OPEN

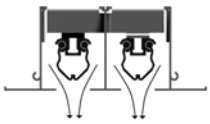
NECK TOTAL PRESSURE (Pa)	30	40	50	60	70
FLOW (l/s) PATTERN A	96	111	124	135	146
FLOW (l/s) PATTERN B	118	137	153	168	181
FLOW (l/s) PATTERN C	96	111	124	135	146
THROW (m) PATTERN A	6.4	6.9	7.3	7.6	7.9
THROW (m) PATTERN B	4.5	4.8	5.1	5.4	5.6
THROW (m) PATTERN C	9.0	9.7	10.3	10.7	11.2
NOISE - NC LEVEL	33	36	38	40	42

VLN 15001 - NECK DIAMETER 300mm FULLY OPEN

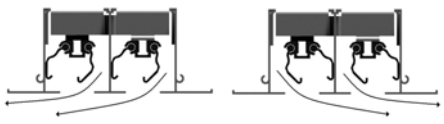
NECK TOTAL PRESSURE (Pa)	30	40	50	60	70
FLOW (l/s) PATTERN A	118	136	151	166	179
FLOW (l/s) PATTERN B	155	179	199	218	236
FLOW (l/s) PATTERN C	118	136	151	166	179
THROW (m) PATTERN A	7.1	7.7	8.1	8.5	8.8
THROW (m) PATTERN B	5.0	5.4	5.7	6.0	6.2
THROW (m) PATTERN C	10	10.8	11.5	12	12.5
NOISE - NC LEVEL	34	37	39	41	43



THROW PATTERN A



THROW PATTERN B



THROW PATTERNS C

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.

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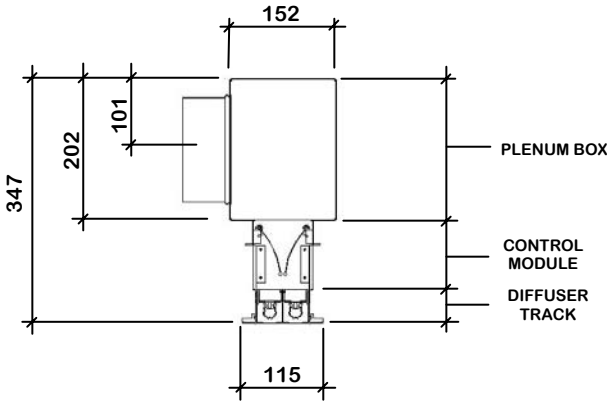
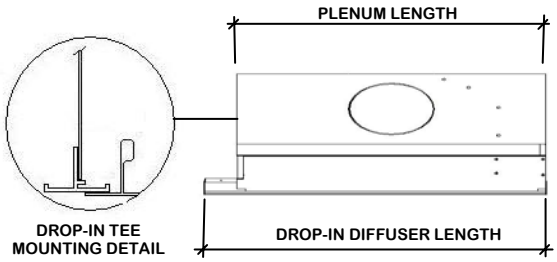
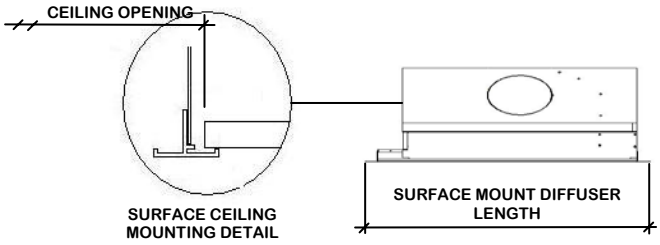
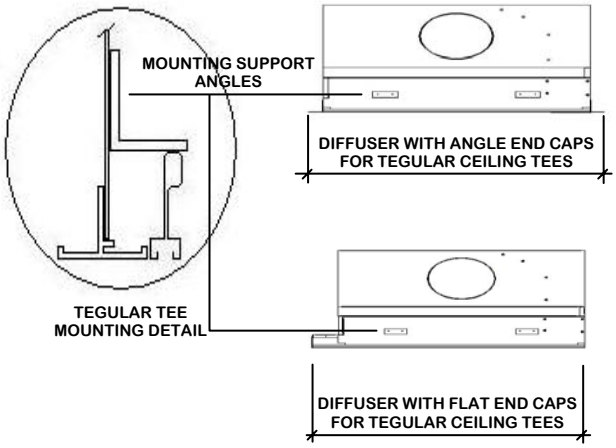
DIMENSIONAL AND MOUNTING DATA









NOMINAL LENGTH	PLENUM LENGTH	EQUIVALENT INLET DIAMETER	FITTED SINGLE DIFFUSER LENGTH (mm)		SURFACE MOUNT CEILING OPENING LENGTH (mm)
			DROP-IN	SURFACE MOUNTED	
600	536	150	595	650	602
900	840	200	1195	950	902
1200	1146	250	1195	1250	1202
1500	1450	300	1495	1550	1502

SAMPLE SPECIFICATIONS

ELECTRONIC VARIABLE GEOMETRY VLN LINEAR VAV AIR DIFFUSION UNITS

(For Multi-Loop Modular Controls)

Supply and install Rickard VLN Variable Geometry Linear VAV electronically controllable Air Diffusion Units where indicated on the project drawings. Each diffuser shall be fitted with a low voltage Vari-Drive actuator (12V DC) housed within an enclosure carried within the VAV air control assembly and shall terminate with extruded aluminium twin slot linear supply air diffusion units. Each air diffusion slot shall incorporate air direction vanes manually adjustable to provide two slot one way horizontal blow, two slot two way horizontal blow, one slot horizontal & one slot horizontal blow or two slot vertical blow.

The VLN control housing shall be manufactured from mill galvanized sheet steel of welded construction, while the linear air diffusion units shall be of extruded aluminium epoxy powder coated with a chip resistant fused epoxy powder.

An enclosure, secured to the side of the VLN air control casing, shall house an electronic control interface printed circuit 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.

ADDITIONAL VARI-DISC INFORMATION

ELECTRIC HEATING

The RICKARD VLN linear VAV ceiling diffusion units may be fitted with electric re-heaters fitted within the control housing. Heater elements used 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 cut-out is fitted. A power-reset 85°C±5°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 are able to 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, bear 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 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, 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 .

HEATER CONTROL

For accurate control of room temperature, the electric re-heater is controlled on a step-less, proportional-integral basis

MAXIMUM HEATER OUTPUT & CAPACITIES

NECK TOTAL PRESSURE (Pa)	30	40	50	60	70	FITTED HEATER CAPACITY (WATTS)
VLN UNIT SIZE	MAXIMUM HEATER OUTPUT (WATTS)					
6001	250	300	325	360	390	500
9001	435	500	565	605	660	750
12001	590	680	760	825	900	1250
15001	725	830	925	1020	1100	1500

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 diffusion units are controlled from a single controller, each unit 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 above table "Maximum Heater Output & Capacities" it will be noted that for each neck total pressure there is a specific heater output quoted and for each diffusion unit size a standard heater capacity is referenced. For example, in the case of a VLN 12001 linear air diffusion unit, the would be factory fitted with a 1250 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 1250 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 for patterns A or C and the minimum desired minimum air flow was 30% of maximum with 17°C air temperature rise, the heater output for a VLN 12001 linear air diffusion unit would be 760 watts, set by using a computer for the ***MLM***, **Mini BMS** or ***Interoperable BMS Compatible Controls***. Kindly refer to Section 11 of this catalogue for more detailed information. Please note that the heater output wattage could be increased if the air flow pattern were vertical by virtue of the fact that VLN air diffusion unit performance is marginally greater than for horizontal supply air flow patterns and hence the reason for selecting the recommended actual heater capacities.

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 air diffusion unit. 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 , 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 the diffuser 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. This is an advantage for ***Green Building*** considerations.

MODULAR DIFFUSER CONTROLS

The RICKARD modular system of controls provides the solution to what is probably one of the greatest problems the building services design engineer faces. Often, during the design and even the installation phase, the engineer does not know who the tenants in a new building are going to be. Partition layouts are decided only when the space is let and the sub-division of the floor space into different temperature control zones can be done only shortly before occupation takes place. However, long before this the engineer must decide on the Master/Slave arrangement in order to allow the contractor to purchase and install the ceiling diffusers. Subsequent changes to allow for tenant requirements incur additional costs and create unnecessary delays.

The RICKARD modular control system entirely eliminates this dilemma! All diffusers can now be installed as “Basic” or Slave units. At any stage, even after occupation, it is a simple process to convert diffusers to Master units where necessary. The temperature controller can be connected to any one of the diffusers serving a particular zone.

This means that the building owner need not supply any more controllers than absolutely necessary and that additional controllers may be added easily at any later stage should the tenant requirements change.

The use of interconnecting control and low voltage power cabling fitted with RJ type connectors at each end eliminates any potential “human error” which so easily occurs when using the conventional soldered plugs or screw terminals. All plugs and sockets are keyed to eliminate the possibility of incorrect connection. All sockets are identified and any plug may be inserted into any socket in a particular group of diffusers.

Given this complete flexibility, the engineer is now in a position to satisfy the demands of any tenant during the entire life cycle of the building, without incurring any unnecessary costs. The concept may be taken even one step further in that it is now possible to complete the installation of all diffusers on a project, without supplying any controllers. Then, when tenants take occupation, they can decide how many controllers are required, depending on the office layout, and pay for the controllers themselves, in much the same way that the tenant pays for their own shop fitting requirements.

MODULAR CONTROLS = MAXIMUM FLEXIBILITY