8

VARIABLE GEOMETRY SIDEWALL VAV TERMINAL

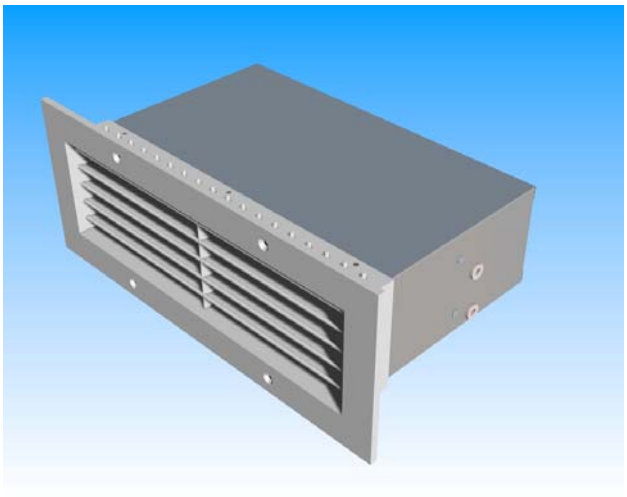
APPLICATIONS

- 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

RICKARD
INTELLIGENT COMFORT CONTROL



WBD

PUBLICATION 2007-8/1

RICKARD
INTELLIGENT COMFORT CONTROL

INTRODUCTION

The RICKARD VARIABLE GEOMETRY Wall/Bulkhead Diffuser (WBD) is normally used in areas where restricted ceiling voids exist or where fully-covered ceilings are not available. The WBD, as the name implies, is intended to discharge supply air into the conditioned space from either a sidewall or bulkhead. Frequently building areas have dividing passageways with ceiling heights lower than those within the areas requiring air conditioning. In this situation the supply air ducting may be run in void between the passage ceiling and the slab above, with the WBD terminals regulating the supply air from the ducting. In many instances these ceiling voids may also serve as return air plenums.

The Rickard WBD has an excellent ability to distribute air across deep rooms as reflected by the throw data indicated in the selection tables. There are, however, instances where these throws are too great for a specific area & in which case, the rear horizontal deflection vanes will need to be adjusted.

When installed, the only visible portion of the WBD is the aesthetically pleasing Rickard linear bar grille. This grille may be supplied with a natural anodized or epoxy powder coated in a wide range colours to suit architectural requirements.

OPERATION

GENERAL DISCRIPTION

Desired room temperature is maintained by varying supply air volume in accordance with demand. Volume control is achieved by opening or closing a set of aerodynamically shaped vanes so as to increase or decrease the aperture through which the air is discharged. This results in the "VARIABLE GEOMETRY" concept which effectively achieves constant air movement in the room throughout the control range from 100% down to as little as 25%.

The position of the vanes is varied by means of an electric or pneumatic actuator driving the vanes in response to a signal from a temperature controller. When used in conjunction with a Rickard electronic controller, the WBD will control room temperature on a proportional/integral basis. Maximum and minimum supply air flow rates may be adjusted electronically on site to suit actual conditions.

MAINTENANCE

No regular maintenance of the Rickard WBD is necessary. However, if the actuators or controls require inspection, the WBD may be easily removed from its sidewall/bulkhead installation by merely removing 4 screws from the face of the grille and sliding the terminal unit from its unique built-in installation sleeve.

WBD SELECTION PROCEDURE

GENERAL

The first consideration when designing a system is to calculate the required supply air volume & temperature to satisfy the room conditions at maximum heat loads. It is recommended that duct is designed and sized using static regain methodology. Supply air velocities in branch ducts should be in the range of 3.5m/s to 7.5m/s. Thereafter the following considerations should taken in account:

THROW

This is the distance from the diffuser at which the velocity of supply air has reached 0.25m/s.

NOISE LEVEL REQUIREMENTS

Published noise levels should be checked against those required for the specific room into which the WBD is to be installed. The NC Levels quoted in the WBD performance table are taken at a distance of 2m from the terminal in a room having a Sound Absorption of 10dB (see note below performance table). These represent only the noise generated by the WBD terminal unit and do not take into account any duct borne noise. To obtain approximate dBA ratings, add 5dB to the listed NC levels.

DUCT DESIGN

Use the static regain method for duct sizing to ensure that duct static pressure remains constant throughout the length of a particular duct run. Best comfort condition result are achieved when WBD terminals are selected in the 30Pa to 40Pa range.

CONTROLS

GENERAL DISCRIPTION

The WBD terminal unit may be supplied complete with standard Rickard modular or BMS compatible electronic controls to provide accurate and reliable proportional - integral cooling and heating control to maintain a constant, comfortable room temperature.

REVERSING CHANGE-OVER

The REVERSING CHANGE-OVER facility is a plug-in conversion to both our Modular an BMS compatible temperature controllers that change the actuator from direct acting to reverse acting. Normally, as sensed room temperature rises, supply air from the WBD is increased, while in the reverse (heating) mode, the supply air volume is increased as room temperature decreases. Practically, this allows for variable cold air supply to cool a building in the summer and variable warm air to heat in the winter.

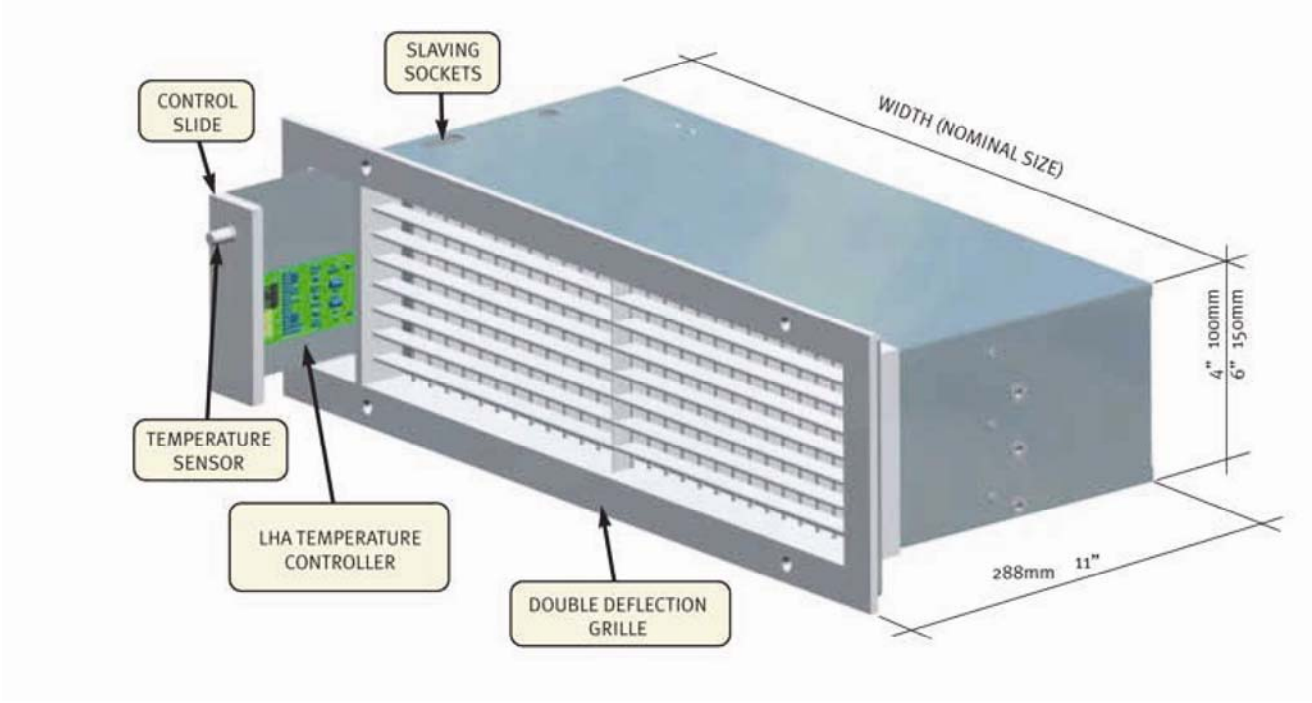
The REVERSING CHANGE-OVER sensor is placed in the primary air stream supplying air to the terminal. Care must be taken that in the event a WBD is fitted with a reheater, the change-over sensor is not affected by radiant heat from the heater. With this facility, whenever supply air temperature exceeds room sensed temperature, the change-over feature is invoked. Normal operation is resumed as soon as the primary supply air temperature is decreased below room sensed temperature.

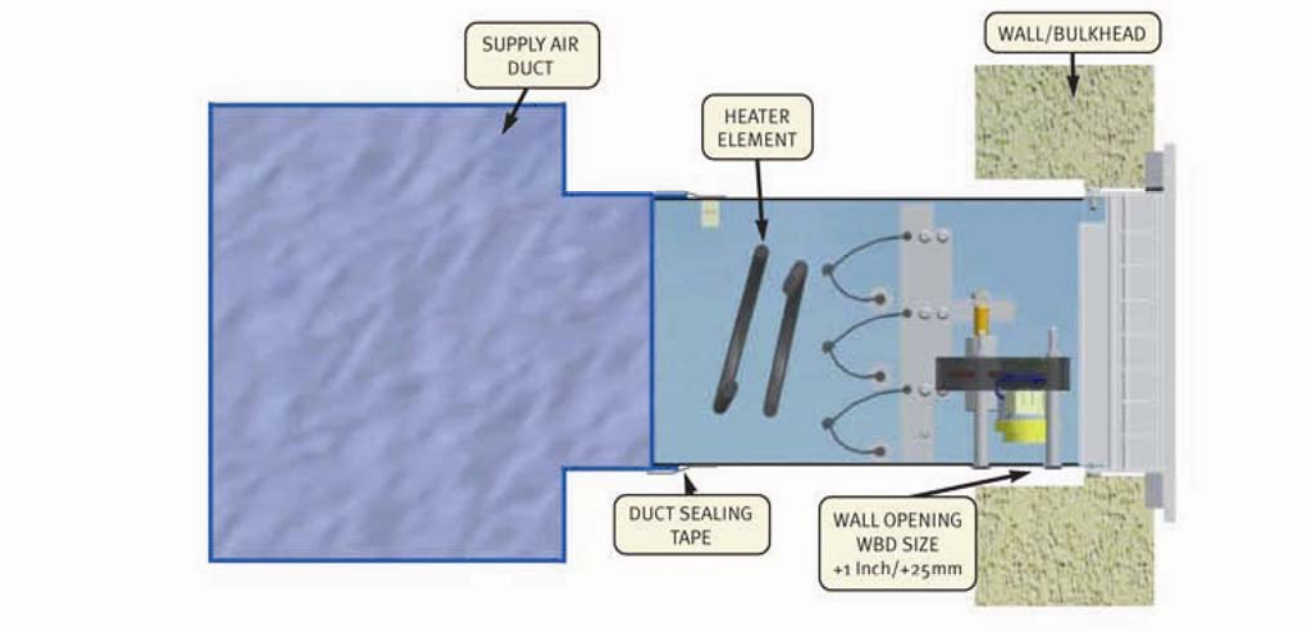
SLAVING FACILITY

It is possible to control up to as many as 15 WBD terminal units off a single master thermostat controller.

POWER SUPPLY

A universal power module suitable for reducing incoming power from between 60V AC and 300V AC to 12V DC, the power required by the Rickard Single Loop and BMS controllers.


SLAVING SOCKETS
CONTROL SLIDE
WIDTH (NOMINAL SIZE)
4" 100mm
6" 150mm
TEMPERATURE SENSOR
LHA TEMPERATURE CONTROLLER
DOUBLE DEFLECTION GRILLE
288mm 11"


SUPPLY AIR DUCT
WALL/BULKHEAD
HEATER ELEMENT
DUCT SEALING TAPE
WALL OPENING WBD SIZE +1 Inch/+25mm

RICKARD
INTELLIGENT COMFORT CONTROL

THE WBD VARIABLE GEOMTRY SIDEWALL VAV TERMINAL PERFORMANCE

The performance data quoted below is firstly for standard WBD terminal units fitted with electric actuators and secondly for those fitted with pneumatic actuators. In the case of those fitted with electric actuators and integral controls, the overall unit width includes provision for a side control compartment.

HOW THE WBD PERFORMANCE DATA WAS ESTABLISHED

Each size WBD terminal has been laboratory tested and checked to establish their respective ratings. To achieve this each unit was installed in a bulkhead and tested for volume using a calibrated orifice in a length of straight ducting. Throw was checked using a hot wire anemometer.

SIZE	READING	STANDARD WBD ELECTRIC DUCT STATIC PRESSURE Pa				PNEUMATIC WBD DUCT STATIC PRESSURE Pa			
		20	30	40	50	20	30	40	50
300/100	FLOW (l/s) THROW (m) N.C. LEVEL	58 5.2 28	75 6.4 32	90 7.2/3.7 36	95 8.3/4.1 38	73 6.3/3.2 29	90 7.3/3.9 33	102 8.2/4.1 37	116 9.7/4.9 39
350/100	FLOW (l/s) THROW (m) N.C. LEVEL	80 7.2/3.8 29	102 8.2/4.1 33	113 9.5/4.7 37	122 10.1/5.0 39	98 6.9/3.6 29	117 8.8/4.7 33	132 10./5.0 36	145 11/5.1 38
400/100	FLOW (l/s) THROW (m) N.C. LEVEL	100 7.8/4.2 29	130 8.6/4.7 33	149 10/5.0 36	155 11/5.1 38	116 8.4/4.5 29	138 9.1/5.0 33	149 10/5.1 36	164 10/5.4 39
500/100	FLOW (l/s) THROW (m) N.C. LEVEL	110 8.4/4.6 29	144 9.4/5.1 34	162 10/5.5 37	170 11/5.4 39	132 8.4/4.4 30	161 9.7/5.3 34	182 11/5.9 38	208 12/6.0 40
600/100	FLOW (l/s) THROW (m) N.C. LEVEL	135 8.6/4.7 30	178 10/5.6 34	205 11/6.4 38	229 13/7.0 40	166 8.8/4.8 30	194 10/6.0 33	219 12/6.6 38	247 13/7.2 41
700/100	FLOW (l/s) THROW (m) N.C. LEVEL	180 8.9/4.9 30	218 10/5.2 34	247 11/6.3 39	277 13/6.8 41	194 9.1/5.0 32	235 10/5.3 34	266 12/6.2 39	298 13/7.2 41
500/150	FLOW (l/s) THROW (m) N.C. LEVEL	165 8.7/4.9 30	219 10/5.6 35	258 11/6.4 39	292 13/7.1 41	199 8.8/5.0 30	240 10/5.9 35	301 12/6.6 39	335 13/7.8 41
600/150	FLOW (l/s) THROW (m) N.C. LEVEL	215 9.2/4.9 31	263 12/6.4 35	304 13/7.1 38	340 16/8.4 41	260 9.8/5.2 31	307 11/6.6 35	356 13/7.5 39	390 15/8.8 41
700/150	FLOW (l/s) THROW (m) N.C. LEVEL	267 9.7/5.2 32	329 11/6.7 35	378 14/7.8 39	410 15/8.9 42	288 10/6.0 32	352 13/7.2 35	407 15/8.8 39	455 16/9.3 42
800/150	FLOW (l/s) THROW (m) N.C. LEVEL	305 10/5.5 32	373 11/7.0 35	431 15/8.3 39	482 16/9.2 42	329 10/5.6 32	403 11/7.4 35	465 15/8.5 39	520 16/9.4 42

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 (i.e. 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. WBD terminals are factory set for a minimum of 30% of the maximum flow levels reflected above. It should be noted, however, that minimum airflows settings are approximate & may require to be reset on site to compensate for actual site system pressures.

SAMPLE SPECIFICATIONS

ELECTRONIC VARIABLE GEOMETRY WBD SIDE WALL VAV AIR DIFFUSION UNITS

(For Multi-Loop Modular Controls)

Supply and install Rickard WBD 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 an extruded aluminium multi-slot linear bar supply air grille.

The WBD 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 on the side of the WBD 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 WBD side wall/bulkhead VAV diffusion units may be fitted with electric re-heaters fitted within the supply air 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, it must be borne in mind that heating in the cooling mode takes place when the unit is supplying minimum air flow and therefore care must be taken to ensure that an excessive supply air temperature rise is avoided. Discharge temperatures in excess of than 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***.

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. 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 & Capacities" in the above, 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 WBD 500/150 VAV unit, the re-heater factory fitted would have a capacity of 2000 watt , which through the utilization of RICKARD ***MLM , Mini BMS*** or ***Interoperable BMS Compatible Controls***, can be electronically set for any output from as little as 100 watts to 2000 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 30Pa and the minimum desired minimum air flow was 30% of maximum with a 15°C air temperature rise, the heater output for a WBD 500/150 required would be 1180 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 control 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 0.50°C below setpoint, the will Triac Controller commence energizing the heater and will fully energize the heater when the room temperature is approximately 1.50°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

MAXIMUM HEATER OUTPUT & CAPACITIES

NECK TOTAL PRESSURE (Pa)	20	30	40	50	FITTED HEATER CAPACITY (WATTS)
UNIT SIZE	MAXIMUM HEATER OUTPUT @ 15°C TEMP RISE (WATTS)				
300/100	320	400	490	510	750
350/100	430	550	610	660	750
400/100	540	700	805	840	1000
500/100	590	780	875	920	1000
600/100	730	960	1110	1240	1500
700/100	970	1180	1330	1490	1500
500/150	890	1180	1390	1580	2000
600/150	1160	1420	1640	1840	2000
700/150	1440	1760	2039	2280	2500
800/150	1650	2010	2330	2500	2500

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. Alternatively, the re-heater sleeve may be fitted with a RICKARD ***Air Flow Sensor*** which will automatically disrupt power to the heater controls when excessively low supply air flow is detected.

REVERSING CJANGEOVER

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 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 and accordingly is extremely energy efficient add to ***Green Building*** considerations.