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ACOUSTIC CHARACTERISTICS OF A NEWLY DESIGNED VAV TERMINAL

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INTRODUCTION

There are many different configurations of air conditioning system and they may supply air either at constant volume, variable temperature or variable volume, constant temperature. All systems are designed to deal with the maximum cooling load of the building but must be flexible enough to adapt to reduced load whilst still operating efficiently.

One way of dealing with buildings having variable loads in different rooms is to instal a variable air volume (VAV) system. Here each room or space is provided with its own VAV terminal unit and sensor/controller. When the room cooling load reduces, a valve inside the terminal unit closes down, reducing the volume flow rate of air into the room.

The valve is usually a metal butterfly or dual butterfly damper, which generates significant levels of noise as it throttles the air flow. Because of this problem, terminal units are usually supplied complete with passive attenuators, which are typically over a metre long. This increases the overall size of the unit, which may make it difficult to accommodate.

The development of the new type of valve was undertaken in order to improve the air flow characteristics, but it became immediately apparent that, subjectively, the new valve was quieter than the standard unit, and a series of acoustic measurements was performed.

DESIGN AND DEVELOPMENT

The new design of valve is of the iris damper type, but without the complication of the multi-bladed mechanism associated with metal valves of this type. The valve consists of a hollow flexible tube mounted inside a dual section of circular ductwork. One of the duct sections is fixed, but the other may rotate under the dictates of the controller, twisting the flexible diaphragm thus reducing the effective cross sectional area of the orifice.

The original design used a tube of latex rubber, which, although satisfactory aerodynamically was not acoustically acceptable. This was because as the rubber twisted, it formed flutes, which were found to vibrate under the influence of the air stream causing high levels of low frequency noise. Several methods were developed to prevent this, such as tensioned bands holding the flutes taut, but were rejected as detracting from the simplicity of the device.

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Subsequent developments have now perfected a design producing considerably lower sound power levels than conventional control valves. Research is continuing into possible refinements in valve design, but the construction of the present valve may be seen in Figure 1.

RESULTS

The sound power levels generated by the Univair valve at several duct static pressures and air flow rates may be seen in Tables 1, 2 and 3 below. For comparison, manufacturer's quoted figures for a typical conventional valve are also tabulated.

Octave band	63	125	250	500	1k	2k	4k	8k
50 l/s								
Univair	43	44	40	37	34	37	41	31
Conventional	--	51	46	49	47	48	53	45
100 l/s								
Univair	50	52	48	45	37	37	40	30
Conventional	--	55	54	58	60	61	64	53
150 l/s								
Univair	58	55	49	46	43	40	40	28
Conventional	--	58	59	63	67	68	71	58

TABLE 1 : Duct static pressure 250 Pa

Octave band	63	125	250	500	1k	2k	4k	8k
50 l/s								
Univair	52	49	49	42	38	42	47	39
Conventional	--	51	50	54	53	50	53	45
100 l/s								
Univair	51	54	53	47	42	43	47	39
Conventional	--	57	57	61	63	62	65	55
150 l/s								
Univair	57	61	58	51	48	46	48	40
Conventional	--	60	62	64	69	70	72	59
200 l/s								
Univair	57	63	60	51	49	47	48	39
Conventional	--	64	65	67	73	76	76	64

TABLE 2 : Duct static pressure 500 Pa

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Octave band	63	125	250	500	1k	2k	4k	8k
50 l/s								
Univair	55	53	56	52	43	45	50	44
Conventional	--	51	52	54	61	54	64	47
100 l/s								
Univair	56	56	57	52	46	47	50	43
Conventional	--	58	59	62	66	64	69	54
150 l/s								
Univair	55	62	63	56	51	49	51	44
Conventional	--	62	64	66	69	71	72	60

TABLE 3 : Duct static pressure 750 Pa

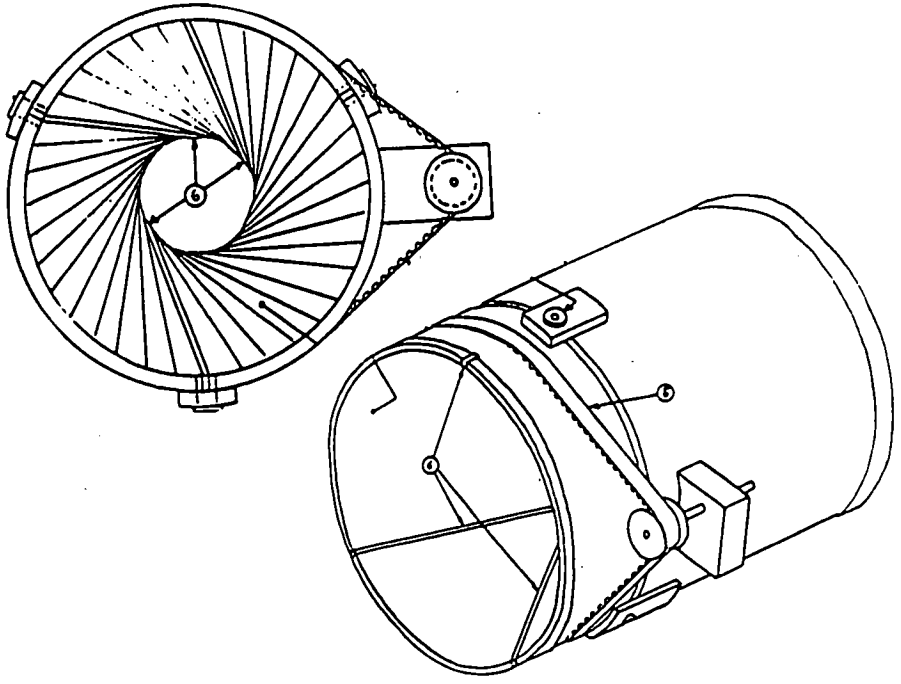

FIGURE 1 : The newly designed valve