waterloo

Waterloo technical note

VAV selection guidance

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The following provides some basic guidance to the process of VAV selection.

VAVs are ***V****ariable* ***A****ir* ***V****olume* devices. Their intended function is to change the volume of air delivered into a room, normally in response to demand established by thermostats or building management systems.

The VAV is controlled using a damper driven by an electrical actuator automatically controlled by the Building Management System (BMS) to achieve the desired air volume. The BMS provides a reference signal of either 0-10V or 2-10V to control the actuator. Unless otherwise specified, Waterloo use Belimo LMV-D2 actuators.

In a typical system the design air volume is that at maximum load in the room. This volume is the effective maximum and as a rule this is known as V^{max}.

If the system uses a turndown ratio to establish the minimum value at which the ATDs will operate effectively this is typically, but not exclusively limited to 50% of V^{max}. For regulating systems where there is no specified turn down ratio the minimum operating volume is determined by the capacity of the selected VAV.

VAV capacity is governed by the size (nominal diameter) of the unit. The capacity is referred to as V^{nom} and represents the volume of air at 10 m/s velocity through the unit.

The standard method of selection would aim to use a V^{max} at no more than 80% of V^{nom} (ie 8m/s through the unit)

If this is not possible, V^{max} should be no less than 40% of V^{nom} (ie 4 m/s through the unit).

Where a 50% turndown is not specified, for best practice, V^{min} should be limited to 30% of V^{nom} or 3 m/s through the unit. The absolute limit is 20% of V^{nom} or 2 m/s. It is not possible to calibrate the actuator to operate at lower velocities, and therefore to improve accuracy and the level of controllability use the 30% V^{nom} value wherever possible.

For 0-10v operation, when calibrated 0v will equate to V^{min} and 10v to V^{max}. For 2-10v operation, when calibrated 2v will equate to V^{min} and 10v to V^{max}. For 2-10v operation when 0v is selected the damper will revert to the closed position.

Note that V^{min} cannot be more that V^{max}.

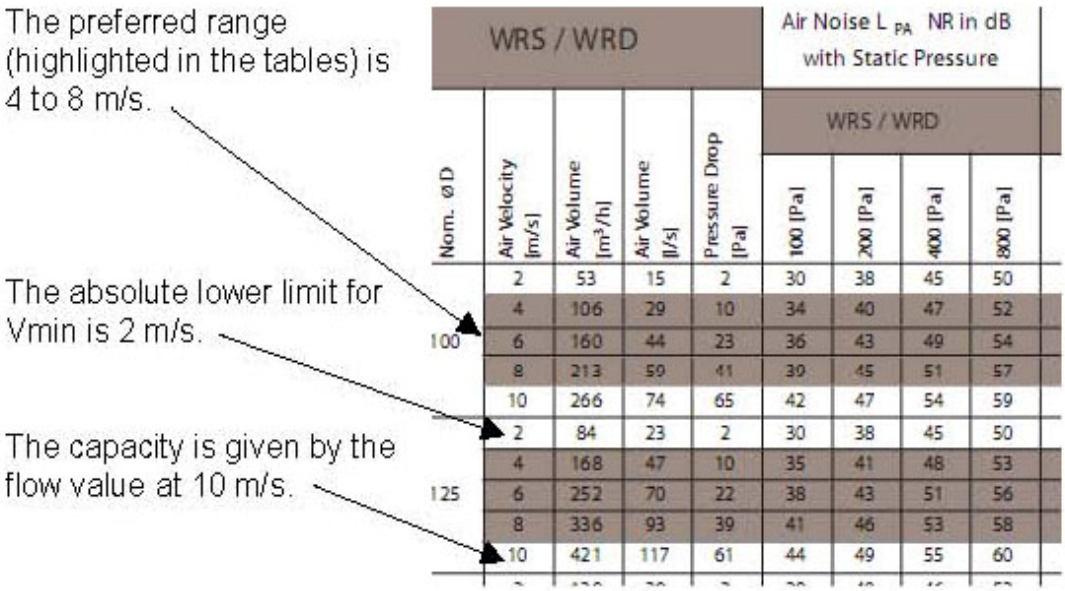
If V^{max} and V^{min} have the same value the unit will operate as a CVD (constant volume device)

The preferred operating range of the VAV is 40 to 80 % of V^{nom}

In summary:

Rated volume	V^{nom}	10 m/s
Maximum volume	V^{max}	40 – 80% of V^{nom} = 4-8 m/s
Minimum volume	V^{min}	> 30% of V^{nom} >3 m/s

All the data sheets refer to velocity to assist the selection process. The given velocity range is 2 to 10 m/s as this describes the characteristics of the unit.



WRS / WRD					Air Noise L_{PA} NR in dB with Static Pressure			
					WRS / WRD			
Nom. ø D	Air Velocity [m/s]	Air Volume [m³/h]	Air Volume [l/s]	Pressure Drop [Pa]	100 [Pa]	200 [Pa]	400 [Pa]	800 [Pa]
100	2	53	15	2	30	38	45	50
	4	106	29	10	34	40	47	52
	6	160	44	23	36	43	49	54
	8	213	59	41	39	45	51	57
	10	266	74	65	42	47	54	59
125	2	84	23	2	30	38	45	50
	4	168	47	10	35	41	48	53
	6	252	70	22	38	43	51	56
	8	336	93	39	41	46	53	58
	10	421	117	61	44	49	55	60

Duct entry conditions

Correct duct entry conditions are extremely important for ensuring that a VAV performs as intended.

The presented data is for systems where the VAV is mounted a minimum of 2 hydraulic diameters of straight ducting from any air terminal device (ATD). Any variation from these inlet conditions will result in a deviation from the calibrated flow range specified at time of order. In such instances the actuators will need to be recalibrated on site. It is the responsibility of the customer to resolve such issues.

General notes on velocity measurement in ATD supply ducting.

Duct entry conditions are as important as the product itself. Poor conditions cause problems with function and performance. A primary performance issue is the rated air volume on which the system design is based. It is self evident that the correct measurement of the supply volume is important as it would dictate the dependant variables of pressure loss and regenerated noise.

If the ATD volume is to be measured it is necessary to do this in a manner that will provide a representative value and there are a number of technical standards available that describe such methods. There are also recommended practices and guidelines that have been shown to provide acceptable accuracy.

Disregard of any of the accepted practices in design leads to the unavailability of testing locations and the use of non-idealised methods. The errors in measurement have to be considered. A simple failure to carry out an accurate pitot survey can easily lead to 20+% errors in measured flow rate. It is invariably the high velocity areas which are omitted in measurements and that consequently a common factor is a resultant mis-estimation of total flow rate.