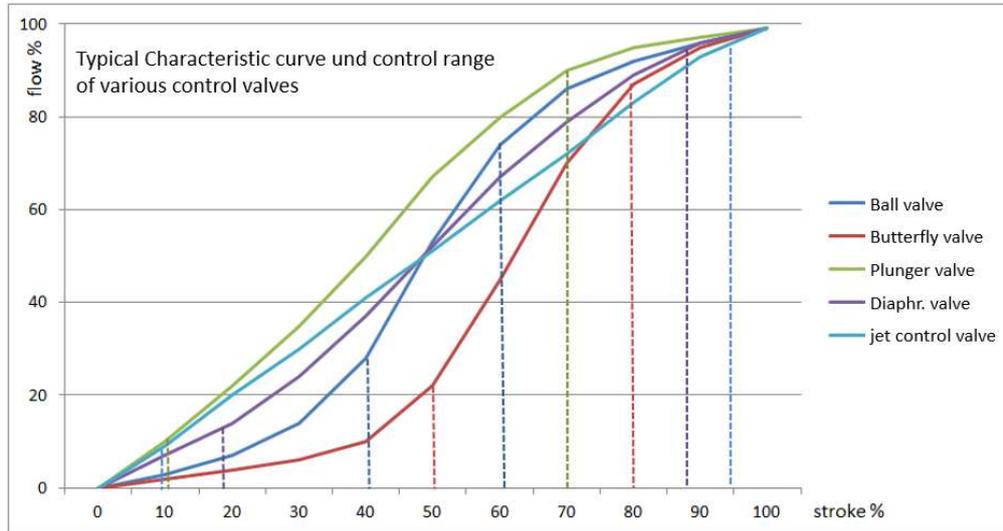


Process stability in aeration control

Part 4: Use of precise control valves

The best aeration system can only run as good as the weakest part runs. Control valves have typically a non-linear control characteristic. Except the VACOMASS® jet control valve with a linear operational characteristic up to 95% stroke, all other valves have a more or less small rangeability. Butterfly valves should be used for ON/OFF only, because of poor control accuracy.^[1]



Diaphragm control valves have a better control performance, but they are sensitive in designing valve size. The linear operation range starts at approx. 20-30% stroke up to 70-80% stroke. This means for MOV systems, it can become difficult to get a stable control performance in the loop when the stroke of the MOV exceeds 90% stroke. But even this range from 90 to 100% stroke is the range with the lowest pressure drop of the valve!

Beside this fact, also the control repeatability must be checked for, which is the sum of the mechanical slag of the valve and the accuracy of the actuator.

Pneumatic actuators in general should be used for ON/ OFF operation only. They have a very poor repeatability. Electrical actuators are of different types: electrical actuators for control use (open-loop actuator), precise closed-loop actuators or variable-speed drives.

Assuming a repeatability of 2% (which is a typical value of some valves), the following table shows the result of air flow rate repeatability when non-linear characteristic and the repeatability due to mechanical slag and actuator are combined:

Stroke %	Flow Nm ³ /h	
100	8314	
98	7384	
92	4594	Δ: 20.2% (931 Nm ³ /h)
90	3663	
82	2423	Δ: 12.8% (310 Nm ³ /h)
80	2113	
52	766	Δ: 8.7% (67 Nm ³ /h)
50	699	
22	152	
20	124	

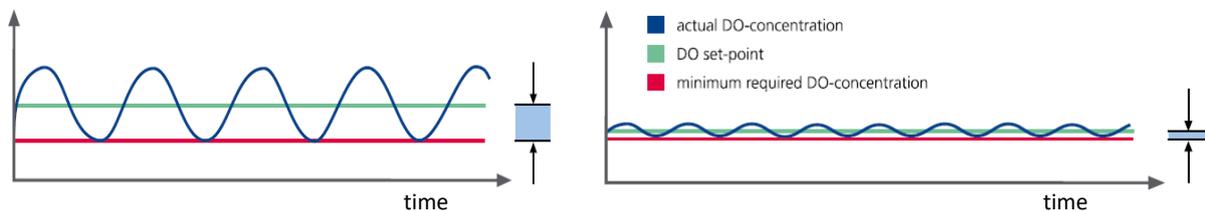
The data in the table are measuring data at a standard test bench of a DN200 diaphragm control valve (not a VACOMASS® one)

Example: you calculate the required air flow rate and the related stroke of the valve. Now you want to adjust the valve to 90% stroke, but in real you get 92%. This will lead to a 20% higher air flow rate!

Than smaller the stroke then better becomes the repeatability, but than higher the stroke then higher is the pressure drop. So the operator has the choice and needs to find a compromise. Major reason for this problem is: mainly all valves used today for aeration air were developed and used originally for water and sludge.

This was recognized by German water specialists too. Therefore they recommend in ^[1] the use of valves, especially developed and optimized for aeration air. They have a wider linear operational characteristic and at the same time a much lower pressure drop even in control operation at 60 or 70% stroke.

Using these valves, over- and shoots of DO-concentration can be reduced – the load-depending air supply is secured, without undesired transport of dissolved oxygen to denitrification tanks.



At the moment there are only two control valves in the market, who fulfil this standard paper: the VACOMASS® jet control valve and the VACOMASS® elliptic diaphragm control valve.

Literature:

^{1]} DWA-M 229-1: Systems for aeration and mixing in activated sludge plants - Part 1: Planning, tender and execution. Beuth Verlag September 2017

Related VACOMASS® products:

VACOMASS® jet control valve

VACOMASS® elliptical control valve

VACOMASS® actuator