

The Vapourtec V-3 pump - A breakthrough for flow chemistry

The development of the V-3 pump has enabled the creation of the new E-Series flow chemistry system.

The V-3 is robust, very simple to use and can pump :

- **strong acids**
- **organometallic reagents**
- **suspensions**
- **gases**

In this article we explain how it works.



The Vapourtec V-3 is a high pressure precision peristaltic pump

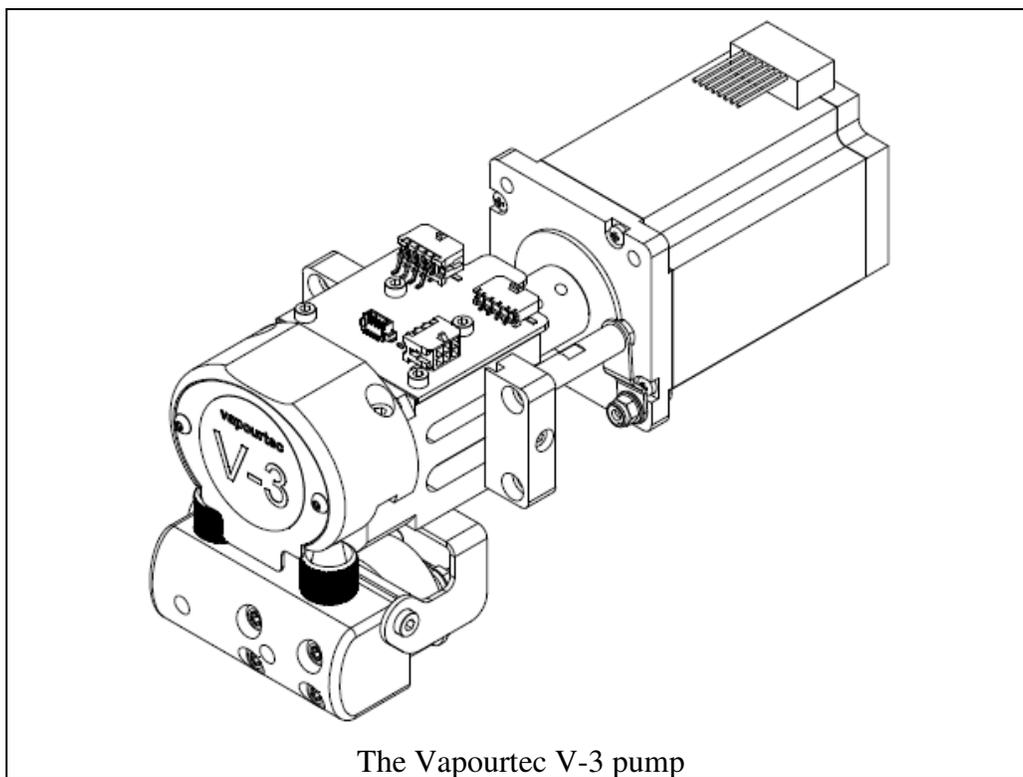
It's capable of :

- **pumping at up to 10bar, with flow rates from 0.10 to 10.0 ml/min**
- **handling strong acids, bases and organometallic reagents, as well as a range of gases**
- **generating smooth output flow across the full pressure range**

A *traditional* peristaltic pump would be unsuitable for flow chemistry because

- it would not withstand the range of solvents and reagents required for chemical synthesis
- it could not generate sufficient pressure
- the output would not be smooth, constant flow rate

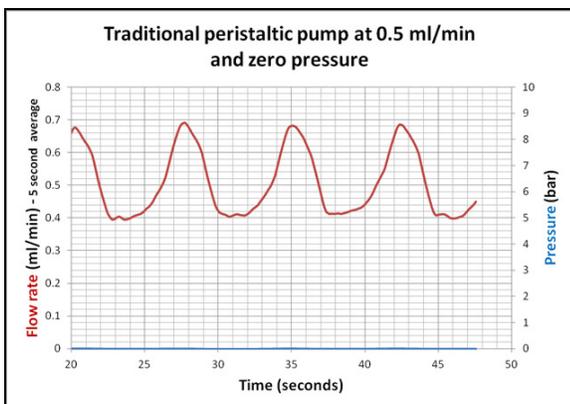
The Vapourtec V-3 (below) features advanced control for smooth output. The tube materials are specially developed in collaboration with a major global fluoropolymer manufacturer, resulting in a pump which can generate high pressures and is compatible with synthesis solvents, acids and bases.



Next Page – See how smooth the output from a Vapourtec V-3 pump at pressure is.

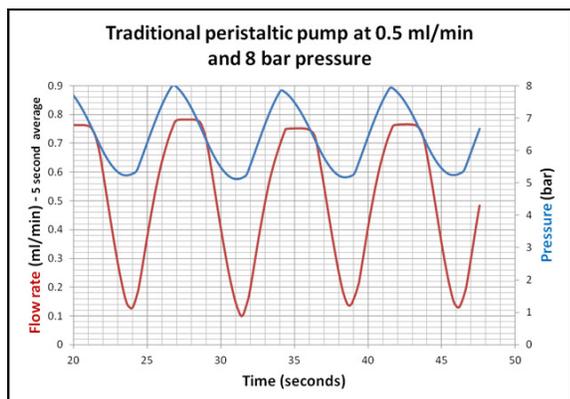
Smooth output

The graphs below show how the Vapourtec V-3's advanced control transforms the output of a peristaltic pump (both in flow rate (red) and pressure (blue))



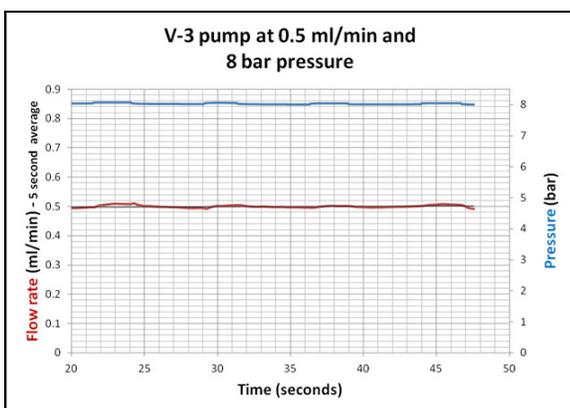
A standard peristaltic pump gives quite significant flow rate fluctuations. This is especially important with two pumped reagents – if these flow fluctuations were out of phase there would be huge swings in reaction stoichiometry entering the reactor.

This graph shows a V-3 pump *driven as if it were a conventional peristaltic pump*.



In fact a standard peristaltic pump becomes considerably worse when delivering against a nominal 8 bar back pressure

(A V-3 pump, but *driven as if it were a conventional peristaltic pump*.)



In this graph the advanced control of the V-3 pump is used. Both the flow rate and the measured pressure show very little fluctuation

How does the Vapourtec V-3 work ?

A standard peristaltic pump runs at a steady rotational speed whereas the V-3 does not. The exact rotational speed profile is complex and is a patented function of the flow rate, rotor position and pressure. The result of this advanced development is total simplicity for the user.

Simple to use

The Vapourtec V-3 is extremely straightforward to use because :

- it will self prime at the start of the day with the push of a button
- the lack of any valves or sliding seals means that
 - it pumps suspensions (or solutions that generate particulates while being pumped)
 - it pumps moisture sensitive reagents without exposing any wetted parts to air during the pump cycle
 - it can pump two consecutive solvents even if they are not miscible
- it's easily dried when necessary
- a low internal pump volume means rapid switching from solvent to reagent with minimal waste or dilution effects
- it pumps air or other gases

The upshot of this is that the time to start an experiment from scratch is greatly reduced, making the system perfect for “taking a quick look” at a reaction.

Example – pumping organometallic Reagents

It is possible to literally switch from pumping water to pumping DIBAL with a V-3, with no pre-drying precautions, with no pump issues whatsoever.

And (like the high end R-Series) the E-Series system has a built in inert gas blanketing system to make handling of air sensitive reagents hassle free. Reagents are aspirated through the septum, and regulated low pressure inert gas is fed into replace the volume removed.

