You pays **your money**

Specifying the right pumps for a plant project isn't as simple as it might seem. Brian Tinham talks to manufacturers' engineers about key developments, trends and issues

Key 'pumps' into Google and you'll be rewarded with a multitude of impressive Internet resources – from Cole Parmer's technical library, to Engineers Edge, the Engineering Toolbox, the Hydraulic Institute, the British Fluid Power Association (BFPA), the British Pump Manufacturers Association (BPMA), even Wikipedia. There's no lack of information out there – indeed almost as many ways of classifying types as there are websites, and plenty of technical overviews.

However, you'll also find that it's not quite so simple to get the information you probably need – like which pump types to use where, why, the pros and cons, and what materials to specify – particularly in light of recent developments (technical and legislative). Understanding the essentials of rotodynamic (centrifugal, mixed flow, axial etc) versus positive displacement (reciprocating, rotary etc) pumps, the various inlet types and so on, helps. But it's unlikely to give you the answers you want.

Classifying pumps by industrial application type would help, but – given that the list runs from paper and pulp to food and beverage, waste water, building services, oil and gas, refining and so on – that's not trivial. Think about the specifications for high-performance pumps, as described in API 610 and ISO 13709, versus the rest. It's marginally easier to classify pumps in terms of pumped fluid (viscosity, shear properties, percent solids etc), by duty (flow rate, total head or pressure rise, and suction conditions, in turn dictating npsh (net positive suction head) requirements) and process conditions (pressure, temperature, phase etc).

But all that is complicated by the additional need to be aware of preferred drive arrangements (electric motor, engine, turbine) and location (submersible or not), as well as construction (size, single- or multi-stage, horizontal, vertical, overhung impeller, between bearings etc) and wetted part materials (not just metal or plastic). Ultimately, plant engineers also need to be aware of the laws of physics as they govern pumping and the importance of the whole system, including pipework – as well as failure modes and maintenance requirements.

Already it's clear that what's really needed is a multi-dimensional matrix – and that any such offering would also need regular updating. Which makes no sense. So it's better to be guided by ideas, views and observations from time-served engineers, particularly those at pump manufacturers helping plant engineers with projects every day.

Talking to them, it's soon clear that there's rarely one solution – as anyone who has specified pumps on, for example, sludge handling will know. Opinion is divided mainly between progressive cavity, peristaltic and ramp pumps, despite their obvious differences. So what do the makers say?

Paul Green, senior sales engineer at

Pointers

- There's more than one way to skin a cat – and that metaphor applies to pumps
- Progressive cavity pumps, peristaltic pumps and ramp pumps are all favoured for waste water sludge
- Speed control, using variable speed drives, delivers flexibility, but engineers need to recall the Affinity laws and understand that motors have their practical limits
- Throughout, it is important to remember the impact of system characteristics in pump selection and sizing

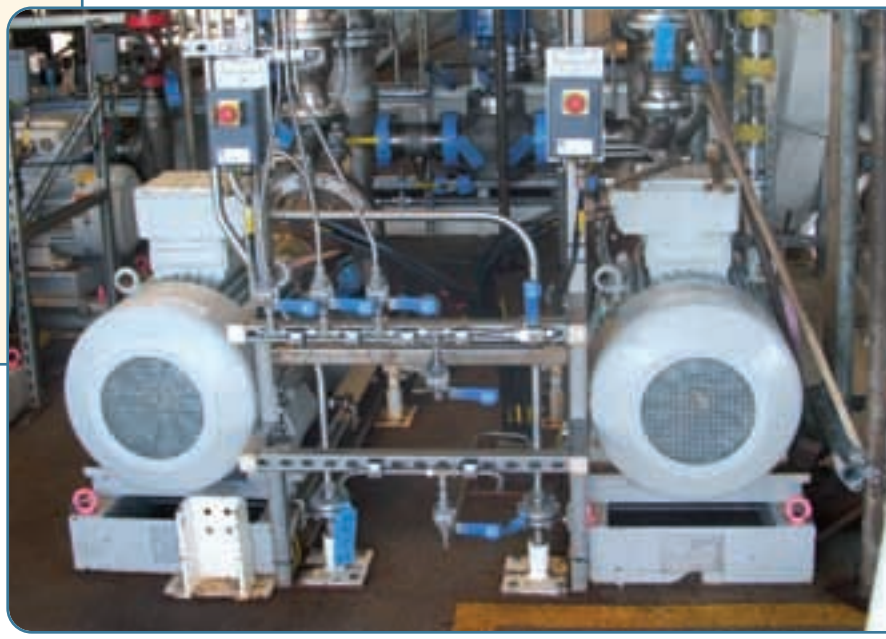
Choppers cut blockages

Pump blockages at an Anglian Water Services pumping station in Huntingdon, Cambridgeshire, have been massively reduced, thanks to Vaughan Chopper pumps, supplied by P&M Pumps.

Problems arose when, during high flow situations, its original pumps became blocked with rag in raw sewage streams – with up to four pump failures a week during storm conditions, resulting in high maintenance costs, as well as spillage.

Anglian says it bought three Vaughan PE8N10 Chopper pumps with 45kW electric motors for transferring sewage at 155 l/sec, since when the pumps have never failed and no wear problems have been reported.

Says site engineer Mick Tomblin: "We have overcome all the operational problems we were experiencing. Pump failures, due to ragging etc, have been eliminated and we appreciate the pump's ability to handle rag matter easily and efficiently."



Amarinth solves sticky pump problem

A clever impeller and pump modification is enabling elastomers producer Polimeri Europa to pump latex coagulate – particularly difficult because of its adhesion and coagulation properties – where no pump had succeeded before.

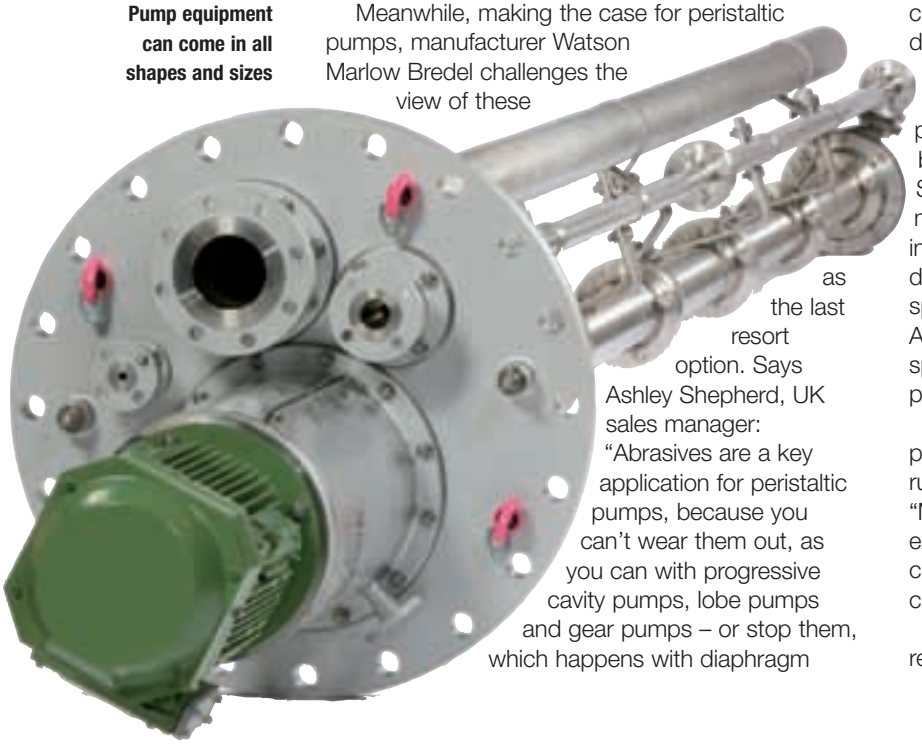
Previously, the company had operated a high cost maintenance regime, with built-up spare pumps, stand-by pumps, and regular overhauls and cleaning to keep process lines running. Pumps were being changed as often as every shift for certain product batches.

Amarinth was contracted to develop a unit capable of running for three weeks without maintenance – but has done way better. It designed a scalloped impeller to minimise clogging, and electro-polished both impeller and backplate to create low friction surfaces. Finishing touches included removable front suction covers for quick access and an adapted mechanical seal to contain the latex coagulate.

Polimeri Europa reports labour costs down by 85% and overall costs cut by 83%, meaning that the pumps will have paid for themselves in under a year. Says Andrew Maxwell, plant engineer materials at Polimer Europa: "The cost savings have been considerable and have turned one of our most problematic maintenance issues into one of our most reliable."

progressive cavity pumps manufacturer Mono: "Our standard pumps are fine for sewage sludge with up to 9% dry solids. They take over where centrifugal pumps start to cavitate, the beauty being they can draw up to 7m water column." Asked about damage from particulate abrasion, he insists it's about choosing the right materials and coatings. Aside from the stator (natural, nitrile, EPDM, fluroelastomer, ethylene, propylene etc), he reminds us that rotors can be machined in everything from tool steel to 316 stainless steel and hastelloy, with hard chrome plate or modified chrome oxide or tungsten carbide coatings – the latter well proven with acidic or aggressive slurries.

Meanwhile, making the case for peristaltic pumps, manufacturer Watson Marlow Bredel challenges the view of these as the last resort option. Says Ashley Shepherd, UK sales manager: "Abrasives are a key application for peristaltic pumps, because you can't wear them out, as you can with progressive cavity pumps, lobe pumps and gear pumps – or stop them, which happens with diaphragm pumps. They can even suck dry without damage."



Pump equipment can come in all shapes and sizes

The downside, he concedes, is a larger footprint and price is typically higher. They're also criticised for pressure and flow rate limits, although Shepherd indicates that they're fine for 90% of applications, and that their robustness means cost savings in terms of maintenance, repair and downtime. "Because they're slow-running – as opposed to Mono pumps running at hundreds of rpm – you don't get abrasion damage. That's also why they're good for foodstuffs, like prawns and apple chunks."

He also argues that installation is cheaper and simpler, since there's no need for strainers, filters, check valves etc. "If you stop one of our pumps, there's always one closure point upstream and downstream." And the big one: "You don't have to drop our pumps into a sump: they're self-priming, so they can be mounted at ground level. We're so confident, we're offering free trials on-site."

What about ramp pumps? David Bates, engineering director at EMS Industries, which has a considerable business in waste water, says they may be Victorian in concept, but they generate a massive vacuum and don't wear or block, even with thick sludges containing rag, grit, bricks etc. "We've updated the design, in terms of clearances between the barrel and piston, the materials, and the inlet and outlet check valves. You just can't wreck them as you can a progressive cavity pump." Why? "Because we're talking about a substantial construction and slow stroking, typically 21—28 strokes per minute." Bates argues that, although capital outlay is high, lifecycle costs are very low.

You pays your money...

So, you pays your money and you takes your choice. Meanwhile, what about trends and developments? Speed control on centrifugal pumps is an obvious one, using variable speed drives (VSDs), with integration into computer control – particularly as VSDs have come down in price and become easier to set up. However, as Tony Salisbury, technical consultant with Amarinth, which majors in the process sector, says: "This does bring into sharp focus the fact that a lot of people still don't understand the relationship between pump speed, flow and head. They need to remember the Affinity laws: that flow capacity is proportional to speed, but head varies with speed squared and power required with speed cubed."

Salisbury also refers to other factors, including positive suction head required, the amount of shaft run-out, friction losses and wear rates, and warns: "Motors are not unlimited in range – they rely, for example, on fan for cooling. And there's also the complication of the relationship between pump characteristic and the system characteristic."

That isn't easy to generalise, given that resistance can vary from a static head with large

Buxton Lime cements flow

Buxton Lime Industries cement plant, which converts waste clay washings from its stone processing plant into cement, is using variable-speed peristaltic pumps to transfer thickened paste underflow from Eimco deep cone paste thickeners (DCTs) to the cement plant.

The DCTs thicken the washings from 5% w/w to 60% w/w, and hence the choice of pumps. A total of four Watson-Marlow Bredel SPX100 duplex pumps has been installed, with each of the two DCTs served by a pair in a configuration designed to guarantee plant availability in the event of a pipe blockage or pump failure.

Each pump unit has an electric motor driving twin pump heads that share common suction and discharge manifolds. In normal operation, the pumps deliver at a rate of 27 tonnes per hour and Buxton Lime oprations manager Nev Mosley reports smooth, pulsation-free flow.

Peristaltic pumps handling difficult fluids at Buxton Lime's plant

pipework, right the way through to a system that's all friction at ground level, pumping high pipe velocities. Which just demonstrates the importance of the overall system in pumps selection and sizing.

Another trend observed by Amarinth is an increasing use of continuous pump condition monitoring, the objective being improved availability – although the company agrees there's a risk of over-instrumentation here. It also cites noise control as increasingly an issue, making the point, however, that, with speed, power and duty defined, there's little that can be done – although positive displacement type pumps are noisier than rotodynamic, given their reciprocating action.

Next, Mono's Green advises users to consider the compact units and particularly newer versions, such as those with its flexidrive shaft, which eliminate the coupling rod pin joint. "If plant downtime costs a few thousand pounds per hour, cutting out pin joint maintenance … and using a robust mechanical seal support system makes a significant difference."

It's also worth noting, in passing, that there are ongoing developments around certification for ATEX (hazardous areas), CE marking and efficiency – the latter, for example, currently affecting the building services and water industries as part of carbon footprint reduction initiatives, but likely to spread.

Let's round up on a couple of useful points. Oliver Brigginshaw, managing director of Amarinth, suggests that, if your pump duty is critical, don't just buy a pump that fits: go for a supplier with good engineering support. "We're building a knowledge base online, so that plant engineers can see, for example, how to disassemble and assemble units without having to dig through data books," he says.

He also advises that it sometimes makes sense not to replace even quite old pumps, particularly if they're big and expensive. Pump specialists can redesign problematic parts, if they are obsolete – and make improvements ranging from reduced leakage paths and improved concentricity to better vibration characteristics. PE

Ultrasonics save Severn Trent

Following disappointing results with ultrasonic level controls on large pumps in a 10m deep sump at Derby sewage treatment works, Severn Trent reports a solution from Pulsar.

The pumps concerned have a combined capacity of around 6,000 l/sec and the control system originally used float switches that were prone to ragging up. That led Severn Trent to try ultrasonics, which failed, mainly because of the tight beam angle required (since the sensor head had to be mounted between two pump heads) and problems with spurious ultrasonic echoes from pump heads, girders and the like in the sump.

Recently, however, it trialled a Pulsar intelligent ultrasonic level system, which overcame the beam angle and unwanted reflections problems – the latter using its Datem echo processing, which strips out competing signals, as well as ignoring surface foam.

Severn Trent says the site is now in the process of removing most of its float switches and moving entirely to maintenance-free Pulsar ultrasonics.