From printhead to printer

Ricoh has recently set up a European Inkjet Technology Centre to better support printer manufacturers using Ricoh printheads.

Although there are a quite a number of vendors developing large format printers, most take their printheads - arguably one of the key components - from just a handful of suppliers. One of these suppliers is Ricoh, which has just opened a new European Inkjet Technology Centre in Telford, UK, to help its OEM customers develop their printer solutions. It’s a fitting location, given that the area was home to an earlier industrial revolution, with plenty of signs en route for Ironbridge Gorge, site of the first iron bridge of its type built in 1779 to help transport raw materials.

Ricoh itself dates back to 1936 and is involved mainly in office copiers and multi-function devices, but with an increasing focus on production printing and, more recently, wide format. It aims to be the top company in its market sectors as far as possible. Thus it has 20.2 percent of the European office market. It currently has 107,000 staff worldwide, including 18,229 in the European, Middle East and Africa region, or EMEA. The Ricoh group is made up of 227 individual companies spread over 200 territories. Last year it earned ¥1924.4 billion (€14bn), with EMEA accounting for ¥421.7 billion (€3bn) in revenue.

The European HQ is in London for production printing and corporate office products, while there’s also an HQ in Holland for office and MFP products. There’s a local UK supply hub at Wellingborough.

Not surprisingly, Ricoh’s main R&D centre is in Japan, but there are facilities in the US, and now the UK, which are mainly to enhance and interpret the core technology. Graham Kennedy, business development manager for Ricoh’s industrial print division, explains: “One of the driving factors behind us setting this facility up was the number of customer enquiries that we had.

We didn’t want to turn those customers away so we have made the investment to enable us to service those customers.”

Ricoh has many customers in the EMEA region so this should make it easier for the company to help them, if only because they will now be working in more or less the same time zone. Kennedy adds: “We do think it’s going to help customers realise their development far quicker than in the past.”

Stainless steel printheads

Ricoh can trace its involvement with inkjet back to 1978 through companies it has acquired. At this time Exxon Data Products developed an inkjet head for phase change...
inks. The product never came to market but elements of it still exist in Ricoh’s current line up.

In 1990 Hitachi bought EDP and built a stainless steel printhead, using an internal thermometer to change the phase. Hitachi went on to set up the inkjet component business, which Ricoh has continued since acquiring Hitachi in 2004. Today Ricoh has over 200 patents for inkjet technology.

The Ricoh printheads are essentially stainless steel units that are bonded together with laminates to form the fluid chamber and ink channels. Using stainless steel means that the heads are compatible with many different types of ink, including UV, solvent, oil and water. They are used in various markets, including wide format, which accounts for over half the uses, as well as 3D, textiles and ceramics.

Masohiro Yagi, senior sales engineer says: “Steel is expensive compared to silicon but then we would need photo lithography equipment for which we would have to invest a lot of money so I think that our manufacturing method is a more stable one for industrial uses.”

Yagi himself has come from the printhead development team in Japan, where he worked with the visualisation and measurement group to come up with a new method of measurement. He explains: “I created a glass nozzle plate so that we could see through the ink chamber as it is always a problem to see what’s going on in the head. I put a tracking particle in the ink and measured the flow rate inside the head where it’s jetting.”

Up to now Ricoh has named its heads according to their generation, with the current heads being called Gen5. But Ricoh is changing this to MH (for Metal Head) 5420 for two colours and MH5440 for four colours.

These latest printheads are a lot bigger than the previous Gen4 models, having 1,280 nozzles spread across four rows, which are staggered, giving roughly 600 nozzles or dots per inch. They produce a native drop size of 7 picolitres, but can produce larger ink drops by stretching them into long tails and splitting them to different sizes which can then combine in flight to form bigger drops. This process can produce up to four different drop sizes from 0-21 picolitres. They work with high temperatures up to 180°, which means that high viscosity ink can be heated up to a high temperature to be jettable.

There are two versions of the Gen5 head, one for water-based inks and one for UV and solvent, which use different adhesives to hold the head together. Kennedy explains: “We need more strength than the previous adhesives because the new head is bigger so we had to develop new adhesives.” There is also a larger version with recirculation for high pigment ink types such as ceramics and white ink.

The Inkjet Technology Centre

Naturally Ricoh wants to work with as many customers as possible and across many different industries, some of which might have conflicting requirements. Kennedy explains: “We have teams that look at specific customer requirements. A large global account might need a specific function and our local teams can look at the implications of this technology.” So, for example, label or textile printers might want low viscosity inks while a 3D printer might be looking for a high viscosity ink.

So part of the Inkjet Technology Centre’s role is to talk with customers and to feed their requirements back to the printhead development teams, as well as to work with those customers to tailor their solutions around the printheads’ capabilities. Much of this involves testing customer inks, as Kennedy explains: “It’s important that we understand the chemistry that our customers are looking to put through the head, so we qualify and grade the inks for use with our head technology.”

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Thus Ricoh carries out a number of tests to see how the inks react with the heads, such as soaking the heads within the inks and leaving them for a set amount of time before measuring the effect on the adhesive used within the printheads.

Another test involves the way the ink reacts to the coating that Ricoh puts on the nozzle plate to ensure that waste ink will sit on the surface and can be easily cleaned away. Keeping the nozzles free of ink that might otherwise dry and cause them to become blocked is a key part of prolonging the lifespan of a printhead. But some inks can react adversely with the coating. Kennedy adds: “We can change the type of coating but some customers use it without a coating.”

Ricoh also tests for whether or not the inks will cause corrosion within the heads, which is a particular cause of concern with water-based inks such as latex inks. It’s not normally an issue with stainless steel but can affect the metal diaphragm, which is a nickel alloy. The actual corrosive penetration can be measured to give a value of mm/year of corrosion, with samples from the past that have failed in the field that are used as references.

They also measure the viscosity of the inks in order to see how well the droplets form and when the tail breaks off. This involves dropping 0.5 ml of ink and measuring it. A water bath is used to control the temperature but if the ink is too viscous to flow properly then the temperature can be increased to reduce the viscosity range. But Yagi points out: “Sometimes UV ink will cure thermally so we have to be careful, but most inks are fine below 60°C.”

Ricoh also supplies the electronics to drive the printheads, which are analogue and so need a digital signal to fire the ink, though some customers prefer to supply their own. Ricoh develops a standardised waveform to fire the heads, but most customers will adapt this as it’s a key element in ensuring that a given ink can be jetted through the printheads.

The Inkjet Technology Centre has only just opened, but Ricoh is expecting around 30-40 OEM customers a year to make use of it. The company is already looking at ways to expand its scope. Yagi says: “We are thinking of making a universal flatbed demo printer so that customers can see their ink with a particular media. They usually do the jetting evaluation and then make their own prototype but we want to help them shorten their development time.”

Ultimately, of course, the main aim behind this facility is to help Ricoh sell more printheads to its OEM customers. But it’s reassuring to see the effort that is put into ensuring that the inks and heads do work together, to prolong the life of the printheads and avoid costly replacements.

- Nessan Cleary

The lab at the Ricoh Inkjet Technology Centre in Telford, UK. Photo © Nessan Cleary