

Pop the hood. Is thermal inkjet technology inside?

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When you buy a car, chances are you check under the hood before making your decision. Does it have four, six or eight cylinders? Does it have a fuel-injection system or a basic four-barrel carburetor? Could you perform routine maintenance on it yourself or would it require a trained service technician?

This same under-the-hood scrutiny should apply when considering mail-printing systems. The ink printing technology inside the equipment will directly affect the machine's speed, print quality, reliability, cost of ownership and ease of use.

Just as the automobile industry has a variety of options suited to different driving needs, mailing-equipment manufacturers offer a variety of printing technologies to meet a range of mail-printing needs. Your business may need high-speed, black-only printing. Or maybe you require high-resolution black and color printing. Perhaps low cost of ownership is the most important consideration for your business. Knowing which technologies are best suited to meet your mail-printing priorities will help you make the right buying decision.

The impact of non-impact printing

Inkjet is one of the most common technologies used in industrial printing, including the mail-printing industry. Introduced more than a quarter-century ago, inkjet printing technology uses small drops of ink to form an image on the page. Inkjet technology is a fast, reliable, non-impact printing method that is capable of producing high-quality results. An alternative to inkjet printing is impact printing, which uses printheads to strike a ribbon against a metal platen to form an image on the page.

Knowing whether the mail-printing equipment is driven by inkjet technology is the first step in the purchasing process—it's comparable to knowing whether a vehicle is powered by gasoline or diesel. If you decide to go with inkjet, the next step is to understand the differences between inkjet technologies.

There are two types of inkjet technology, continuous-flow and drop-on-demand. Both methods are common in the mail-printing industry. The earliest form of inkjet printing, continuous-flow, deflects ink drops from a constant flow of ink to form an image. Drop-on-demand inkjet printing, introduced in the 1970s, fires ink drops as they are needed to form an image. The two most common drop-on-demand technologies are Piezoelectric (piezo) and Thermal Inkjet (TIJ).

Piezo inkjet technology uses mechanical forces within the print cartridges to eject ink. A piezoelectric crystal flexes a diaphragm next to the firing chamber. This physical displacement causes ink to be ejected onto the paper. The mechanical movement requirements of the diaphragm necessitates a large ink chamber for each

nozzle, limiting the number of nozzles per inch that can be attained.

TIJ technology uses tiny resistors that rapidly heat a thin layer of liquid ink. The heated ink causes a bubble to form, expelling the ink through a nozzle. As the bubble collapses, it creates a vacuum that pulls in fresh ink. This process is repeated thousands of times per second. TIJ technology allows many nozzles per printhead, which provides small drop sizes, fast speeds, outstanding system reliability, and highly controlled ink placement.

Hewlett-Packard and Canon were the early pioneers of TIJ technology, and both companies have remained committed to enhancing it. In the 1980s, TIJ managed to gain widespread acceptance in office environments, which is a feat continuous inkjet and piezo inkjet had been unable to accomplish. Because substantial investment in TIJ research and development has been made by companies like HP, the 1990s saw black and color TIJ printing widely implemented in home, office and industrial applications, boasting high print quality, reliability and speed capabilities all at a highly affordable price.

As you research mail-printing equipment, you will encounter thermal inkjet, piezo inkjet and continuous inkjet technologies. Comparing technologies in mail-printing equipment is much like comparing cars; all models have strengths and limitations. The key to a satisfying purchase is deciding which strengths are best suited to your company's needs.

When it comes to mail printing, TIJ delivers

Print quality, speed, flexibility, reliability and low operating costs are requirements in the fast-paced, competitive mail-printing industry. As you consider mail-printing equipment and compare the printing technologies, how do they stack up next to your mail-printing needs?

Print quality

Whether you're metering mail, addressing envelopes or personalizing messages, print quality is always a top consideration in the mailing industry. Mailers that are difficult to read will be rejected—by your client, by the post office or by the recipient. So, as you compare mail-printing equipment, find out whether the printing technology delivers the resolution quality you demand.

Thermal inkjet technology can provide outstanding print quality in any print mode, from low to high resolution. TIJ is the only inkjet technology that currently offers pigmented ink. Pigmented inks deliver rich, sharp black text that resists fading, smearing and smudging, even in harsh industrial environments. Pigmented inks are also capable of high-quality results on more types of plain paper than dye-based inks.

The complex formulation of pigmented inks is difficult to master and requires an advanced ink delivery system to keep printhead nozzles clear and firing properly. The ink and the printhead must work together precisely to ensure optimum performance. HP, one of the leaders in thermal inkjet technology, uses an advanced ink delivery system with specially formulated pigmented inks delivered through hundreds of tiny nozzles on the printhead. The result is precise, controlled placement of the black pigmented inks.

Another consideration is the print quality throughout the machine's operational life. Find out whether the system uses separate ink cartridges and printheads or a self-contained, disposable print cartridge. If the ink cartridge and printheads are separate, ask about the expected life of the printhead and the process involved in replacing the ink supply and replacing the printhead. The quality of the printhead directly affects the quality of the printing. If a printhead needs repair, find out where the service comes from and at what cost. Ask how much downtime to expect when repairing or replacing a printhead. With disposable print cartridges, the ink supply and printhead are contained in one component. When the ink runs out, you simply snap in a new print cartridge and continue printing. The print quality remains high throughout the life of your machine because your printheads are always kept factory fresh.

Speed

Speed is critical in most mail-printing applications. Your primary concern may be how many pieces can you process in an hour, but speed should be considered in conjunction with other factors.

A racecar goes fast, but it isn't fuel efficient, cost-effective or practical for most driving purposes. Comparatively, a mail-printing machine that prints fast may not print well, may not be affordable, or may be difficult to operate and maintain. Equipment that does not deliver print-resolution quality will also not deliver adequate response rates.

Consider a printing technology that uses a combination of factors to achieve high speeds without sacrificing the other elements that are important to your business. TIJ uses hundreds of tiny nozzles firing at a high frequency to deliver more ink with one pass, thereby allowing high-quality, high-speed printing. Printing systems with fewer nozzles require multiple passes—thus more time—to achieve the same high-quality results.

When comparing machine speeds, remember to consider the time necessary to replace ink and worn or damaged printheads, to clear paper jams, and to perform routine machine maintenance.

Reliability

Downtime costs money. Whether it's time spent clearing paper jams, reconfiguring jobs, swapping inks, or maintaining printheads, if your machine isn't running, your company is losing money. So before you decide on a machine, find out about the equipment's track record for reliability.

TIJ technology uses an advanced ink delivery system to clear ink from the nozzles to prevent clogging and reduce excessive nozzle priming and flushing. The TIJ ink-drop firing system is not sensitive to small air bubbles in the firing chamber, avoiding print quality problems or delays from printhead purging routines that are needed to eliminate trapped air. When you compare equip-

ment, understand what steps are required to replace inks, including making connections, ink filling, and using vacuum pumps or cleaning fluids. TIJ provides a clean, low-maintenance system and makes ink swapping easy.

Another consideration is how the machine operates in varying temperatures or humidity. Some technologies are sensitive to extremely high or low temperatures and/or humidity, resulting in printhead corrosion. Find out the operating range of the equipment—and whether the range is suitable for your work environment—before you invest in new equipment.

Flexibility

Does your company print exactly the same information on the same printing material every time? If not, look for equipment that gives you the flexibility your company demands.

TIJ technology allows multiple print cartridges that can be clustered to provide wide printing widths at a low cost. That means you can print a wide variety of information, in multiple sizes and colors, both text and graphics, all in one pass through the machine.

Your business may only be printing in black ink today. But TIJ technology gives you another option—color—in case you ever need it. You can easily change ink colors or print black and colors to meet different application, imaging or material requirements. Just snap out the black print cartridge and snap in the color print cartridge, or vice versa. You don't have to clean the machine or clear any ink lines, so the changeover is fast and simple. The same simple snap-out, snap-in system applies to replacing empty print cartridges.

Cost of ownership

The total cost of ownership is a consideration usually found near the top of a buyer's checklist. Many factors—beyond the equipment purchase price and ink replacement costs—contribute to overall cost of ownership.

❑ Equipment

Complex machine electronics can mean large, expensive equipment to operate and maintain. TIJ technology provides integrated circuit electronics on the printhead, allowing the nozzles to perform at high frequencies with high throughput and high print resolutions. The integrated hardware and electronics of the printhead reduces the machine's electronics design. This helps keep the total system cost down. The high-density nozzles enable a smaller printhead size, thus allowing a small machine footprint. TIJ also provides self-contained ink supplies, so no external recirculation or ink management systems are required. This, too, keeps the machine's footprint small and keeps costs down.

❑ Maintenance

The plug-and-print capability of TIJ technology provides ease of use and ease of maintenance. TIJ print cartridges can be cleaned by simply wiping the printhead as recommended by the manufacturer. Empty or damaged print cartridges can be replaced quickly—no skill or technical knowledge required. Other systems may require a skilled maintenance technician to replace inks or printheads.

Another factor to consider when comparing maintenance

cost is the length of downtime required for service. If a printhead needs to be serviced, can it be done locally or do you need to ship the part elsewhere for repair? With TIJ, simply replace the print cartridge and resume printing. Also, remember to take into account the machine's warm-up time. Delays in startup after maintenance will also contribute to the overall cost of ownership. TIJ technology allows machines to operate without a warm-up cycle, so operations can resume immediately after maintenance is finished.

❑ **Labor**

If the machine is complicated to operate, you will require more-skilled operators for every machine. If the machine is simple to operate, one operator may handle multiple machines simultaneously. TIJ technology, widely used in home and office printers, is designed for ease of use. That factor alone can save considerable money in operator training.

❑ **Ink**

Beyond the cost to replace the print cartridge or ink supply, also consider the total system cost associated with mail printing. Systems that require excessive flushing and priming can waste valuable ink and production time. The advanced ink delivery system used in TIJ technology eliminates ink waste and system downtime. There is also added value with getting a new printhead with each new ink supply, thus eliminating worn printheads and reducing nozzle-clogging problems. Consider the time savings associated with replacing a single print cartridge versus replacing the ink supply and the printhead.

❑ **Future growth**

Make sure the equipment you choose is able to grow with your business. Mail-printing systems are being improved constantly, due in part to the continuous improvements in TIJ technology. Thermal inkjet innovations represent more than 80 percent of the inkjet patents issued this decade, and 40 percent of those patents involve ink and media technology. These advancements have allowed HP to build fast, affordable, photo-quality color printers for the home and office. Now, HP makes the same proven TIJ technology available to industrial printing equipment. As a result, mail-printing machines are capable of running faster and producing better-quality printing—in more configurations and ink colors—at a lower operating cost.

The right fit

Many mail-printing equipment manufacturers leverage the expertise of inkjet technology leaders by entering into licensing agreements with companies like HP. HP has made substantial investments in developing, testing, perfecting and patenting the complex ink formulations and TIJ printing technologies. By leveraging HP's investments and expertise in inkjet technology, mail-printing equipment manufacturers can deliver the benefits of TIJ—high print quality, fast printing speeds, consistent reliability, ink and media flexibility, and low cost of ownership—at a competitive market price. To identify equipment based on HP's TIJ technology, look for the trademark logo, "Featuring Hewlett-Packard INKJET TECHNOLOGY."

Like car shopping, it pays to do your homework before making your equipment decision. An understanding of the technology

inside will help you more easily compare the equipment's strengths and limitations to find the right fit for your business today—and for the future.

(Clay Higgins manages the mail-printing segment of HP's Specialty Printing Systems Operation. More information about HP's OEM business can be found at www.oeminkjet.com.)

Buyer's Checklist

All equipment has its strengths and limitations. Knowing your priorities—and understanding a little about the technology under the hood—will help you make the right buying decision. Here is a checklist of features to help you get started:

Print quality

- Dots-per-inch capability
- Range of print quality resolutions
- Readability in every mode
- How does each mode impact printing speed
- Does it meet/exceed postal regulations for weatherability

Cost of ownership

- System cost
- Replacement ink price
- Replacement printhead price
- Cost of flushing and priming
 - Ink waste
 - Downtime
 - Skill required
- Maintenance
 - Cost for downtime
 - Cost for parts
 - Cost for labor
- Operation
 - Skill of operator
 - Number of operators vs. number of machines
 - Skill required for maintenance
 - Skill required for ink swapping
- Capable of machine upgrades

Speed

- Machine set up
- Machine operation
- Ink swapping
- Maintenance
- Multiple print modes

Reliability

- Uptime
- Performance of nozzles
- Expected life of printheads
- Service intervals of printheads
- Operating environment

Flexibility

- Ink colors
- Resolution
- Printing width
- Media flexibility
- Upgradeability