

MAKING YOUR MARK

Comparing Ink-Jet Marking Technologies

by Michelle Spaulding

With so many methods of marking products available today, it can be a bit trying to figure out which technology best fits a particular application. Ink-jet printing methods have gained popularity in the past five years, particularly within the engineered wood industry. As a result, it's important to know the many differences between these technologies. First, let's understand why ink-jet has become the recommended prescription for marking applications throughout many industries. Then, we will take an in-depth look at the specific technologies.

Why Ink-Jet Technology?

You may already be marking your logo with tracking and operational information on most products. If you are doing this with roller coders, stamps and stencils, be mindful that new advancements in ink-jet marking technology can put you ahead.

Ink-jet marking produces some of the best quality marks possible on most building products. The surface of a wood product is textured, which makes it difficult to master high quality marks from contact printing solutions. Stenciling can become a very messy method of marking products because it requires manual interruption and usually results in wasted paint.

Inflexibility is a final downside to contact printing. When messages are changed, rubber type or dies must be removed, requiring handling of messy dies. Periodic cleaning of the roll coder is also time consuming and expensive to keep print looking clear and attractive. Further, contact printers or redundant printers do not facilitate the potential for test marking or branding additional products because you need to change type with each new product. With an ink-jet printer, to change a printed message the operator simply selects the desired message from the printer controller. In less than a second, the printhead begins printing the newly prompted message without any process interruption.

Industrial ink-jet printers have become much more than simple marking systems. They can improve your productivity through automation, provide feedback and reports on the products traveling through your lines, and communicate with PLCs and other devices throughout your plant. Product coding changes from the PLC are instantaneous and can prevent costly errors, such as forgetting to change a stamp at product changeover. Applications such as private branding for large home improvement stores require corporate identity logos that can be changed instantly on demand with ink-jet, regardless of product changeover. This technology can also save money by providing you with the capability to print only what you want and where you want on each product instead of the typical continuous string of print required by contact printing.

There are many different types of ink-jet systems. Most fall into one of three main technologies or methods. These include continuous (CIJ), high resolution, and drop-on-demand.

Continuous Ink-Jet for High-Speed Marking

Continuous ink-jet (CIJ) printers are a non-contact form of high-speed small character printing used to apply variable information, such as tracking codes, product names and logos to individual products on the production line. These small character printers are often used to print date, batch, time and shift codes onto wood products such as door frames, moldings and more. CIJ printing is fast and versatile and can print on most materials regardless of size, profile shape and texture. Most CIJ printers are easy to use, they have proven reliability, are of superior design, and are capable of matching the speeds of the fastest production lines.

These printers work by jetting a high velocity, continuous stream of ink through a nozzle. This stream is broken down into identical droplets at an estimated rate of 80,000 drops per second. These droplets are selectively charged and deflected to print dot matrix characters. Undeflected drops are re-circulated, recycled and returned to the ink tank. All CIJ printers use the same basic technology, but they are not the same in terms of design.

What are some of the downsides to CIJ printing technology? These systems are only designed for small character marking (just under .5" maximum character height). The larger the font size selected for printing, the slower the actual printing speed. These facts truly limit the applications you will find satisfied with this solution.

Another important weakness of this technology includes ink and consumable expenses. There is a defined marriage between the inking wells and printer controls that make changing a system's ink type problematic. If a CIJ customer wishes to change the ink they are currently using, most will have to send their printer to the manufacturer for service.

Inks developed for this technology tend to be more costly as well. Printing requires the use of two fluids—ink and makeup solution. Over time, the makeup solution tends to evaporate, wasting valuable dollars. This technology requires absolute viscosity control that in turn requires the extensive use of makeup fluids to maintain vital ink properties. Poor viscosity management will lead to poor print quality. VOC emissions are also a concern as industries are being required to comply with environmental protection measures.

Flexibility is not an attribute in which CIJ excels. Most controllers are limited to the number of printheads they can control. Many CIJ systems are unable to run more than two printheads simultaneously. Overall, higher maintenance requires a higher level of monitoring to work well in tough environments. Finally, if a user is printing a larger font size, speed capabilities are drastically reduced. Characters are formed by a raster pattern of drops that are vertically printed. The more drops vertically printed, the longer it takes to sweep the ink across the substrate.

High-Resolution Ink-Jet for Ultimate Quality Marks

High-resolution ink-jet printers operate by either a Piezo-electric printing process or thermal ink-jet process. These printing systems are used to print high quality, large sized logos and text as well as small character traceability information.

The outstanding benefit of all high-resolution printers is that they yield the highest print resolutions available. The character size ranges are more flexible and small to large ranges are available from a single system. Inks come in limited choices, but are environmentally friendly formulas. These printers can also run multiple printheads, most up to four.

Piezo-electric printers operate via acoustic sound waves. A small series of openings in the printhead are channeled into a large number of nozzles. Using sound waves, the ink is then moved from the nozzle openings to the product. No pressurized ink systems or mechanical valves are used to assist with the process of moving ink through the printhead and onto the product. A weakness here is the use of non-pressurized ink systems that rely on gravity feed ink delivery.

A simple test to see if this technology will work in your application is to place a cup of water filled to the brim in the area where the print head will be mounted. If the water spills over the brim while product traverses by, then this technology may fail as ink starvation will occur.

Another high-resolution technology is thermal ink-jet. The thermal ejection process in this method is very energetic. Inside the printhead, a vapor bubble acts like a piston to drive ink and air bubbles out of an orifice. Ink droplets are forced out of the printhead and onto the product. Again, there are no moving parts in the printhead, just the ink itself. The fact that this process does not involve moving parts inside the printhead reduces routine maintenance for lighter industrial applications.

There are some disadvantages in using high-resolution ink-jet solutions for marking engineered wood products. The most scrutinized weakness is the simple fact that these systems were originally designed for light industry applications printing posters and other print media where the substrate media being marked is under strict control, such as package identification, mail processing and carton marking.

High-resolution printing solutions use more ink and require more material handling solutions to counter environmental challenges, such as dust and vibration commonly encountered in engineered wood marking applications. Most high-resolution printheads can't be serviced, which can be costly to maintain optimum print performance. They also require a much closer print distance between the printhead nozzles and the in-line products. In this scenario, the printhead virtually kisses the product that threatens a collision of substrate and printhead in an uncontrolled environment.

Just how do you control engineered wood products traveling at speeds up to 400 feet per minute? Unfortunately, there is not an easy solution to this potential problem. Furthermore, high-resolution ink-jet printers tend to produce lighter marks on dark substrates like wood products because ink selections are not expansive, consisting of mostly water-based formulas. These tend to make lighter marks and require longer drying times. In addition, marks may bleed when exposed to wet conditions.

Drop-on-Demand for Maximum Durability

Drop-on-demand (DOD) technology is an extremely reliable printing solution for harsh industrial applications. This versatile printing method is frequently used to print quality large logos, some spanning many feet in size. Other prime applications include grade marks, association marks, nail/pattern marks and even smaller sized marks, such as date and batch codes. One of the most economical methods of printing, DOD systems typically conserve inks, marking only the necessary ink drops with very little waste.

The flexible nature of this technology allows for adapting to almost any application need. Printheads can be stacked and electronically stitched for logo and large format printing. A single controller can perform both small and large character marks. Simple interfacing options, like touch screen controls, bar code scanner linking and PLC integration make operation and setup convenient for end users and original equipment manufacturers alike. In addition to ease-of-use, DOD print speeds stack up

well with the competition. Finally, there is a large selection of industrial-grade inks to choose from when using this method of printing. These are some special inks designed specifically for engineered wood applications, and include fluorescent, solvent-based, fast dry and UV-stable inks.

The DOD printhead design is robust and taking a closer look reveals the excellence of its use in most heavy-duty applications. Each printhead is comprised of several stainless steel, micro-solenoid single-valves and specially developed rubber compounds for all plungers and other seals. Drop-on-demand technology operates on a dot matrix valve-jet process that begins when a column or row of nozzles are sprayed together to form a printed character as the product moves. The more nozzles in a printhead, the more dots are available for printing. Special printheads have been developed containing up to 32 individual valves in a single head for maximum flexibility in marking applications.

The most noticeable weakness of DOD technology is the final print resolution. It boils down to the user's choice between print quality and performance versus cost savings.

Although these systems are engineered to be tough for industrial applications, they do require daily maintenance of wiping the printhead faceplate and weekend flushing. Disposing of flammable fluid inks (solvent-based) can also be a hassle at times. Waste management procedures must be followed to properly dispose of these inks when necessary. Engineered wood product substrates tend to be very porous and require large printed dots to overcome absorption to provide a quality mark. Other printing technologies need to dispense more ink drops to combat absorption, which increases cost per mark.

How to Choose the Best Fit for Your Application

In summary, each of the technologies described in this article have specific areas of excellence. Continuous ink-jet best fits applications requiring only small character marks such as date codes, batch codes, and lots. It is not versatile in terms of character size ranges; however, it yields some of the fastest marking speeds available for a single line of print.

High-resolution solutions are the best fit for marking applications demanding the highest print quality. They tend to cost a little more in terms of consumables and require special material handling to survive harsh conditions, but no other technology can match the print resolutions these systems can produce.

Drop-on-demand ink-jet fits applications that above all else demand reliability and flexibility. They are the true industrial powerhouses that can stand up to the dust, vibration and abuse still encountered in the engineered wood industry.

Future Ink-Jet Applications and Developments

There are a number of possibilities for the future of ink-jet coding. Among these are advanced integration with vision systems for character recognition, production volume tracking, and measuring devices for scrap or fault marking. Some other new applications place a marketing emphasis on the entire concept of marking, resulting in value-added products with improved brand recognition. These techniques include nail and pattern marking, small and large format logo printing, instructional marking, and even multi-color printing.

New developments in ink-jet may even further bridge the gap between the more specialized ink-jet technologies. Continuous ink-jet printers may soon be capable of

running larger numbers of printheads, and more industrial-grade inks with the ability to make darker marks on wood substrates may become available for high-resolution printers. Drop-on-Demand will expand to mark with higher print resolutions and control even larger numbers of printheads from a single control unit.

In the end, the best way to select an appropriate ink-jet solution is to look at the details of your application: visibility and quality of mark; stability and longevity of mark; cost per mark; robustness of printing system; need for a supplier that can provide the turnkey system and ownership of the installation; custom software for special applications; supplier with engineered wood products marking experience. Are you looking to secure cost savings, reliability or high print resolution? Perhaps you are even looking for all three.

Take time to carefully consider the needs of your application before buying a marking system. Review the following points: purpose, size and location of mark; production rates and location of printer; number of products, substrate, and number of code changes; operation and maintenance costs; best technology and supplier for application. If you keep the mark's purpose and end goal at the top of your mind throughout your selection process, you won't go wrong. ■

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