



Removable Codes for Glass, Plastic and Metal

Reusable containers are good for the environment and the bottom line, but **require removable codes** that won't be smudged or rubbed off during processing or at the shelves.



The sustainability benefits of refillable beverage containers are plentiful and include the reduction of solid waste, energy consumption and greenhouse gas emissions. Refillable containers can be made from a variety of materials including glass, aluminum and plastic such as polyethylene terephthalate (PET) and high-density polyethylene (HDPE).

One of the challenges is developing a method that applies a code that is durable enough to remain on the product while in use, but can be easily removed during washdown so that the manufacturer can reuse the container and apply a new code.

This white paper details common applications, pitfalls and best practices for applying removable codes.



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Removable codes must be reliable through the entire life-cycle

The right ink requires an optimal balance between two extremes. On the one hand, if the ink is very aggressive, it serves the needs of the supply chain well, but is challenging for the washdown process and requires more detergent. On the other hand, if the ink has less adhesion, it can be easy to dissolve during washdown, but may result in unreadable or missing codes throughout the supply chain.

Not only does the coding equipment need to print in the high-speed and demanding bottling environment, but it needs to provide superior ink adhesion to ensure accurate tracking and traceability.

The manufacturer's distribution partners rely on these codes so they can efficiently rotate stock at various points in the supply chain, which helps reduce waste from out-of-date products and ensure the freshest product is stocked on store shelves. And retailers and retail customers depend on easy-to-read 'best-by' and 'sell-by' date codes that do not fade or rub off under normal conditions. At the same time, the ink needs to be easily and cost effectively removed during the washdown process at the manufacturer facilities.

Removable code applications



Three common applications where beverage manufacturers require codes that feature superior adhesion and removability at the appropriate time include:



Beer/soda (glass and plastic bottles):

Codes are applied on the bottle after they've been filled, while standing in an upright position and moving at high speed. Once on retailers shelves, the codes need to withstand a variety of possible environments including cold temperatures from commercial refrigerators; abrasion from product-to-product contact during stacking and transportation; condensation from changing temperatures and submersion in water and ice by consumers.



Water (five gallon plastic containers):

Codes are applied on the container neck or on its body, while standing in an upright position or rolling horizontally. Once in the marketplace, the code must not come off during handling in transportation or at the customer site. These containers are also susceptible to condensation from changes in temperature both during storage and while in-use.



Beer (aluminum kegs):

Codes are typically applied on the container's body during conveyance. The code, in addition to showing freshness, is typically used to provide traceability and clearly distinguish the product type on the keg.

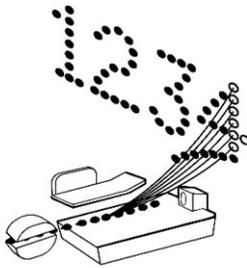
In all three circumstances, the codes will need to be removed during the washdown segment of the container's life-cycle so they can be sanitized, refilled, recoded, and reused.



Benefits of CIJ in the beverage industry

CIJ printing is one of the most versatile and durable options for manufacturers and packagers. With this technology, the printer creates a stream of small ink droplets that are delivered to the product or substrate through a nozzle. These droplets receive a charge and are deflected and deposited in the correct position on the substrate. Advanced software algorithms help control the printer hardware and create optimal ink drop break off and flight path. These systems yields one simple yet important objective – consistently high quality codes at high speeds. The unused droplets are cycled back into the printer to eventually become part of the ink stream again.

This method of marking is used most often to print alphanumeric codes such as expiration dates or manufacturing data and is ideal in the beverage industry for several reasons. It is a non-contact printing method where nothing touches the product except the ink, so there is no potential for damage to the packaging. It is specifically designed to operate at the extremes of bottling line speeds. CIJ printing delivers legible printing on nearly any surface, smooth or irregular and can apply codes on the side, top, bottom or even the inside of a product, such as plastic caps. It also utilizes a range of CIJ inks including fast dry, high contrast and most importantly for refillable applications, condensation resistant/caustic removable.

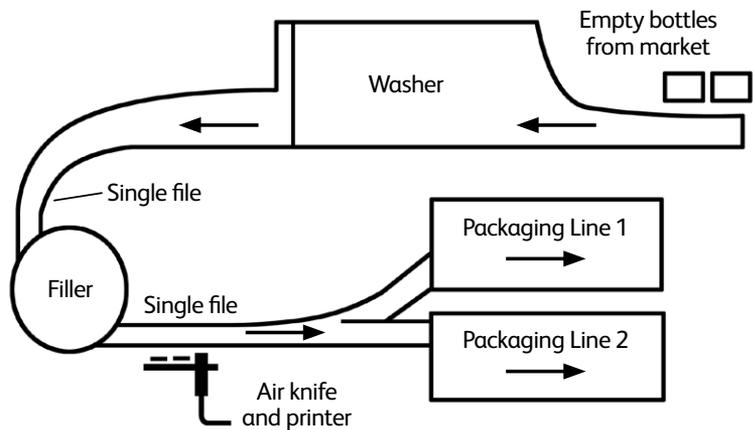


CIJ technology diagram

CIJ printing's versatility allows it to apply codes to a wide variety of packaging types and to be installed on a range of equipment. This illustration shows a typical layout of a beverage bottler and where a CIJ printer is normally located.



Continuous ink jet printer



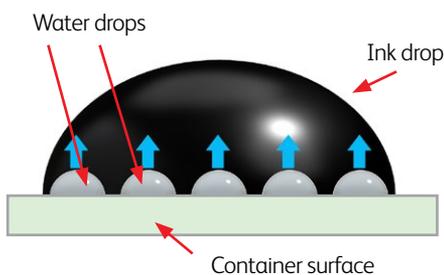
Operational coding challenges



The physical environment of the specific application will impact the three main condensation variables, which will ultimately affect the quality of your code.

Environment

The beverage industry presents an extremely demanding manufacturing environment. Between the high-speed production line, rapid changeover and zero tolerance for downtime, every piece of equipment, including the printers must operate at peak performance. Adding to the challenge is the physical environment of a bottling facility, which is typically wet and warm, resulting in condensation on the product surface. If not controlled, condensation can slow down the ink dry time and impede adhesion. Too much condensation can also make the ink bleed on the surface and degrade print quality. Nevertheless, inks can be thoughtfully formulated to utilize some of this condensation to enhance ink adhesion.



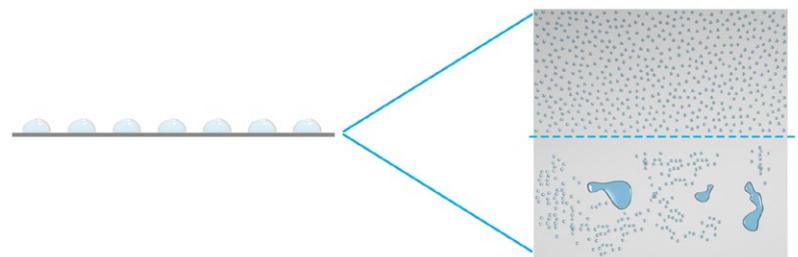
Condensation variables

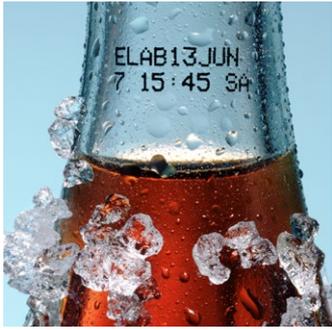
The three main variables of condensation are:

- Speed: This is how fast the water droplets are formed on the surface of the container. The two major factors are the humidity in the air and the temperature differential between the liquid being filled and the air in the factory itself.
- Amount: This is the size of the droplets that sit on the surface to be coded. Similar to speed, the major drivers are the humidity in the air and the temperature differential.



- Distribution: This is how the drops are distributed across the surface. The driver is the surface energy of the containers and any special coatings that may be present. Different surface conditions would generate a different type of water distribution.





A challenging printing environment as a result of unregulated condensation, along with improper coding techniques and inappropriate ink selection, may result in poor code quality and missing codes. Some of the most common issues are:

1

Low ink adhesion

2

Increased dry time

3

Blurry codes

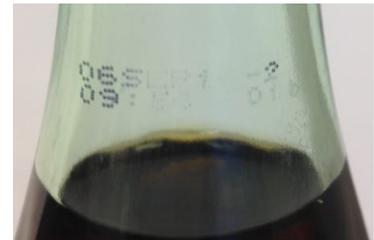
4

Non-removable

Types of code quality issues

1. Low ink adhesion:

This can result when too much condensation is left on the surface of the container. As a result, the code may not print completely or may be removed due to handling. In the best-case scenario, this error would be detected at the bottling facility where the product would be removed before distribution. In the worst-case scenario, the code would come off in the hands of a retailer or customer when they touch the container.



Low ink adhesion - missing code

2. Increased dry time:

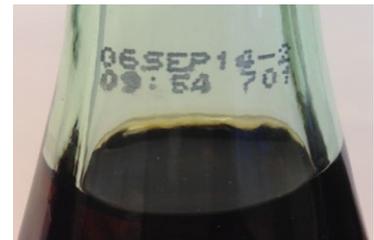
Controlling dry time is critical, otherwise codes can be immediately washed away while on the line due to the wet environment, splashing liquids, and general container contact with the conveyor rails.



Low ink adhesion - smeared code

3. Blurry codes:

A blurry or “bleeding code” can happen when a drop of ink spreads as a result of excessive condensation. The net effect is irregular shaped drops. Sometimes two or more drops touching each other can create a deformed character – impeding readability.



Blurry code

4. Non-removable:

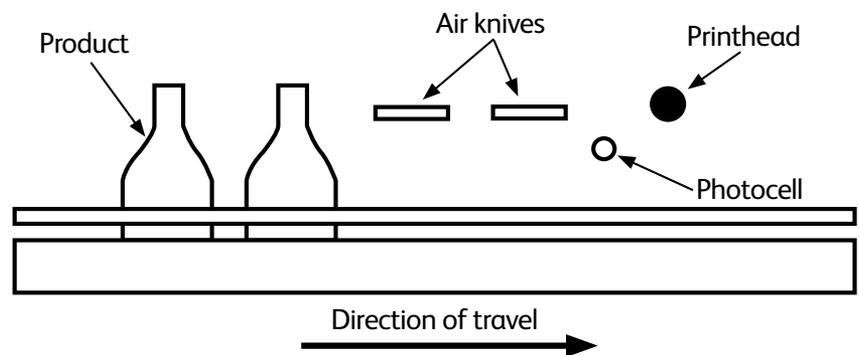
In the other extreme, if the wrong ink is used a code might stick well to the container, but be more difficult to remove during the washing process. This can result in not only higher costs for detergents, washing additives, and energy to maintain elevated temperatures in wash water, but increased wear and tear on the container, especially with plastic which is more sensitive to aggressive detergents.

Best practices for reusable code application

With so many variables to control on high speed lines (above 700 bottles per minute), and operational cost targets to hit, it is hard to provide a one-size-fits-all recommendation for removable code applications.

It is strongly recommend that you consult a specialist to help ensure you have the right equipment, supplies, and proper installation setup for your unique requirements. Having said that, here are several best practices that can drastically improve code quality:

1. **Use an air knife.** A dual-headed air knife is recommended for cold fill bottling applications. The angle of the knife, air flow rate and positioning are critical to remove a sufficient amount of condensation at the right time to improve the adhesion of the ink. The location of the air knife in the conveyor is indicated in the drawing below.





2. **Code above the fill line or in the bubble.** On most plastic and glass bottles, it is best to apply the code above the fill line, as the amount of condensation would be less here than in areas of the container where there is liquid. This area of the container will have a lower level of condensation than those in direct contact with the liquid.

3. **Have clean containers.** All containers should be completely cleaned before filling. In situations where the caustic detergents were not completely rinsed during the initial washdown process, a more thorough cleaning may be needed as outlined below in best practice number four. Because in most bottling operations there could be five to ten minutes between cleaning and filling, it's important to completely rinse all detergent so that it does not dry on the bottle and create a barrier to ink adhesion or begin dissolving the ink.



Coding above the fill line

4. **Have the right washing parameters.** Below are the recommended parameters for washing:

Parameter	Recommended Values	Comment
Caustic level	2.0 - 4.0% by volume	
Additive level	0.2 - 0.3 % by volume	Highly variable depending on the additive
Tank temperature	> 60° C / 140° F	Hotter is more efficient
Water hardness	< 150 mg/l	Lower is better

Choosing the right ink



Picking the right ink for refillable and reusable containers is even more challenging and creates a unique balancing act.

On one hand, the ink must be able to endure a variety of conditions and environments to accurately and efficiently identify and track products. On the other, a difficult to remove ink could result in higher costs for detergent and container as mentioned above.

Removable inks are specifically engineered to dissolve when introduced to sodium hydroxide, a common ingredient in caustic industrial detergents. Special ink additives (adhesion promoters) enable the ink to penetrate through the condensation layer to allow a second component, resin, to then provide final ink code adhesion onto the glass bottle.

Ideally, the ink chemists, bottlers and detergent manufacturer will work together to ensure the inks provide the proper adhesion and optimal removability during the wash-down process. It is highly recommended that the selected inks are printed on the actual containers and tested in the actual washing environment before implementing a full solution.

Inks of various properties and colors are available to provide removable options for the bottling industry, including:

Ink Color	Plastic	Glass	Metal	Solvent Type	Dry Time
Black	X	X	X	Methanol	1-2 seconds
Red	X	X	X	Methanol	1-2 seconds
Black	X	X	X	MEK	2-4 seconds
Black	X			Methanol/Water	5-7 seconds
Black	X	X	X	MEK	2-4 seconds
Red Opaque			X	MEK	1-2 seconds
Yellow Opaque	X	X	X	MEK	2-4 seconds

The bottom line:

By using refillable beverage containers, your company is lessening the demands on our natural resources and providing great environmental benefits. While printing removable codes on refillable containers is challenging and requires thoughtful analysis of many variables, the right partner can help ensure your success.

Videojet is a world leader in beverage coding and marking solutions, with more than 325,000 printers installed worldwide. Here's why...

- We have over 40 years of experience developing inks for the beverage industry. Our state-of-the-art inks have a special chemistry that is uniquely designed to be soluble during washes.
- We partner with detergent manufacturers to develop inks that work well together.
- We develop solutions with Uptime Peace of Mind. Our 1000 Line printers deliver 99.9 percent availability.¹
- We have the biggest service and support network in the industry.

Contact the experts at Videojet for a free line audit of your process, inks and environment. Our team can run a sample coding test on your container and send it back to you to try in your washing system.

For more information about our solutions for the beverage industry, please contact Videojet Technologies.

¹Results of 99.9% availability obtained from a survey of customers representing over 400 printers on active production lines. Over half of the surveyed customers experienced 100% availability. Individual results may vary.

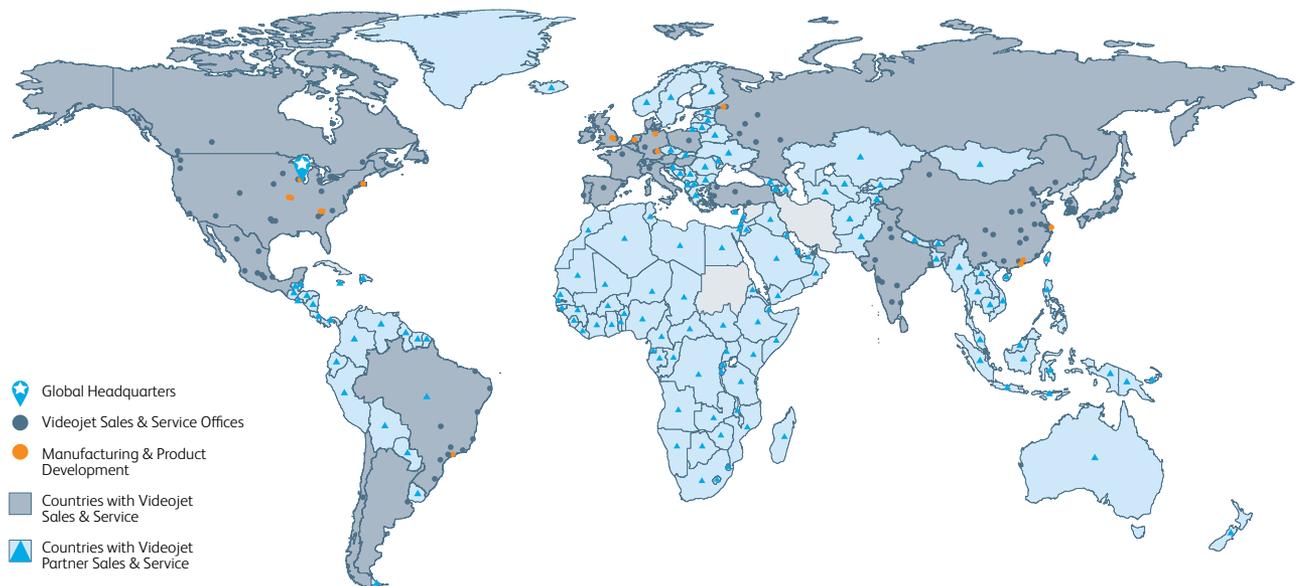
Peace of mind comes as standard

Videojet Technologies is a world-leader in the product identification market, providing in-line printing, coding, and marking products, application specific fluids, and product life cycle services.

Our goal is to partner with our customers in the consumer packaged goods, pharmaceutical, and industrial goods industries to improve their productivity, to protect and grow their brands, and to stay ahead of industry trends and regulations. With our customer application experts and technology leadership in Continuous Ink Jet (CIJ), Thermal Ink Jet (TIJ), Laser Marking, Thermal Transfer Overprinting (TTO), case coding and labeling, and wide array printing, Videojet has more than 325,000 printers installed worldwide.

Our customers rely on Videojet products to print on over ten billion products daily. Customer sales, application, service and training support is provided by direct operations with over 3,000 team members in 26 countries worldwide.

In addition, Videojet's distribution network includes more than 400 distributors and OEMs, serving 135 countries.



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