Ultimate code quality on a wide variety of substrates

Coding and marking sample guide

CO_2 Laser

VIDEOJET

Achieving the best laser mark is all about the specification process.

Laser marking systems can generate high-quality marks on a range of materials provided the substrate, the application, and desired mark are well understood. Variations in specified wavelength, marking head and chosen lens will result in different marking effects on a given substrate. Work with a laser expert to identify the right specification for your application.

Selection, quality and expertise

With over 30 years of laser innovation, Videojet understands the importance of product configuration to achieve your desired mark. Through a diverse combination of marking heads, lenses and wavelength options, Videojet can deliver market leading 21 spot size options to match your unique application requirements. More spot size options allow a broader range of effects from fine to thick line marking.

Wavelengths available:

10.6µm
Ideally suited to most standard consumer packaged goods applications that mark paper, cardboard, various plastics and labels as well as wood and glass products

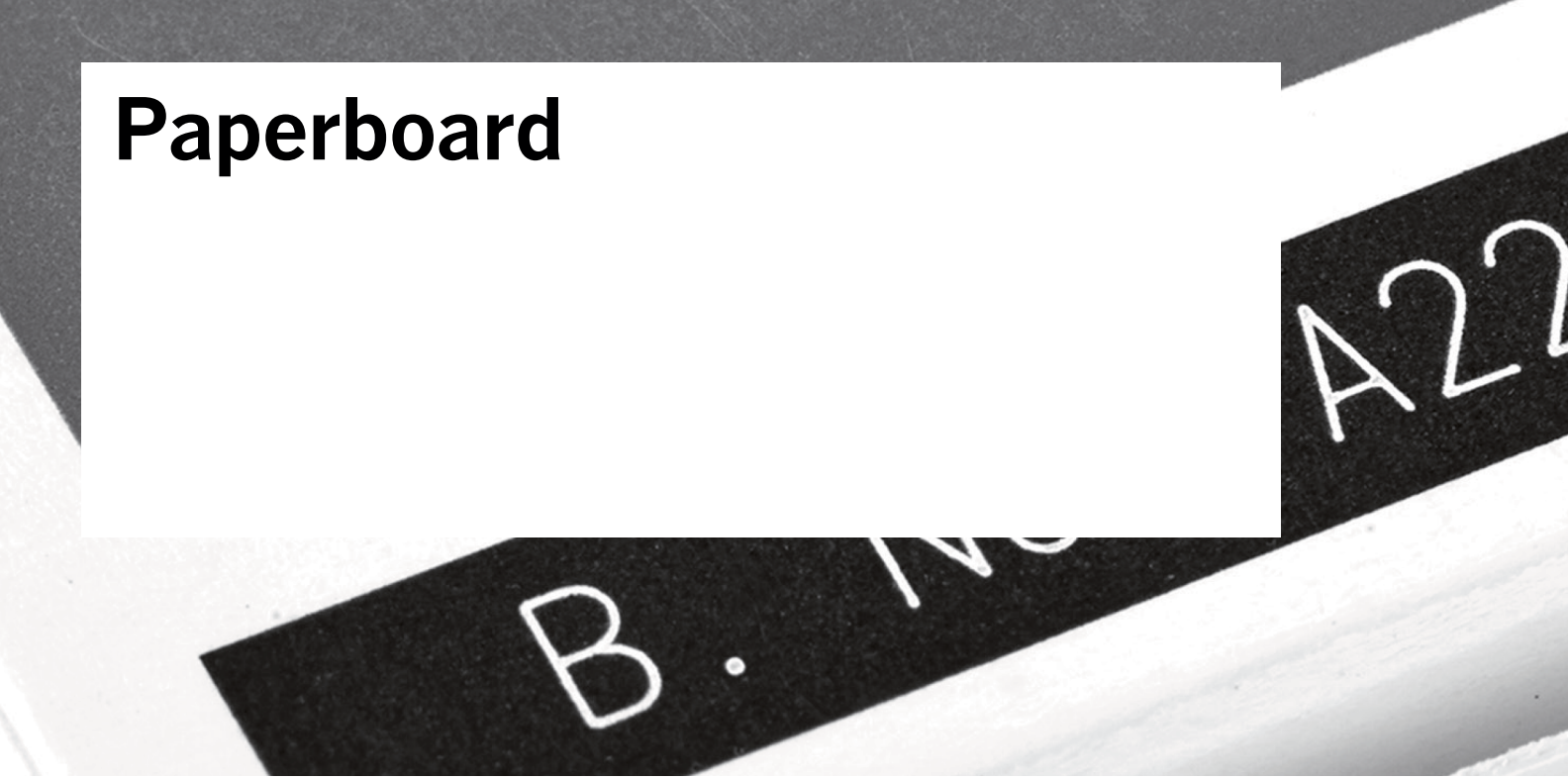
10.2µm
Best applied to laminated cartons commonly used in many cosmetic and pharmaceutical applications

9.3µm
Specifically suited for marking on PET plastic, typical of beverage products

Laser mark effects include:

1. Colour change as a result of a chemical reaction between laser and product
2. Engraving of the surface, e.g. foaming into PET or etching into glass
3. Ablation or colour removal of the surface coating to reveal alternate colour underneath
4. Carbonization or controlled burning of wood or board based materials
5. Melting different plastic materials to achieve either a raised or concave effect

Paperboard



Typical coding requirements:

Laser marking on paperboard is a particularly effective application for CO_2 lasers, achieving highly attractive mark effects. To achieve the best readable contrast, a darker colour paperboard or dark mark window is recommended..

4 typical types of paperboards:

1. Painted paperboard

2. Non-painted corrugate board

3. Laminated (PE) painted paperboard (typically used in Asia for pharmaceutical packaging – this requires a different wavelength compared to other paperboards)

4. Paperboard with laser reactive coating (Datalase is one provider of this solution)

Marking effects:

- Painted paperboard – colour removal of paint or carbonization onto white space. This is a very fast method of laser marking
- Non-painted corrugate board – carbonization provides a dark, high contrast mark
- Laminated (PE) painted paperboard – colour removal of paint or carbonization onto white space
- Paperboard with colour sensitive coating – an ultra-fast process of colour change upon reaction with laser sensitive coating. This provides a high-quality, clear mark with minimal laser power required

Mark speeds:

Typically up to 40,000 products per hour (based on a single line alphanumerical code)

Best wavelength:

Non-laminated and laser sensitive coated paperboard – 10.6µm

PE-laminated paperboard – 10.2µm

Logo, product information and bar code

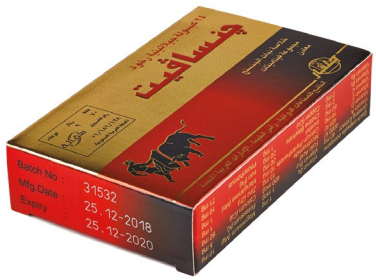
Colour change on laser-sensitive coating

Alphanumeric code

Colour removal on red surface

DataMatrix and lot code

Colour change on white surface



Labels

Typical coding requirements:

Similar to paperboard, CO_2 laser marking on labels provides a high-quality, good contrast mark result. There are two main types of labels: paper labels and metalized labels. Examples shown on page 7; left and middle are paper and right is metalized. Other labels suitable for CO_2 laser are laminated and laser-sensitive coated.

- Paper labels are best matched to CO_2 lasers, achieving high-quality marks in fast time
- Metalized labels typically require more power to achieve the same mark result

Marking effects:

- Paper label – colour removal of painted layer or carbonization on a plain white label. Carbonization needs a slightly longer time to mark than colour removal
- Metalized label – colour removal of painted layer

Mark speeds:

Typically up to 80,000 products per hour (substrate dependent) (based on an alphanumerical code as shown in examples)

Best wavelength:

All label types – 10.6µm

Date and lot code

Colour removal

Plastic

Typical coding requirements:

There are many different kinds of plastics and they each have various reactions to CO_2 laser marking. For example, PET and PVC both achieve attractive codes, but with very different end results. Colour removal on painted plastic materials, such as films, can achieve a very high-quality mark effect.
See below for further information on the specific mark effect that can be achieved on each substrate.

Marking effects:

Foil

Foils and films can react differently based on the makeup of the plastic substrate. If the film is painted, the effect is colour removal. If coated with laser-sensitive layer, the result can be an almost black mark (see dairy film, right) that is achieved in an ultra-fast marking time. In contrast, a clear see through film would invoke a melting of the material to produce a semi-transparent engraved type mark. Things to consider when laser marking foils and films:

- Risk of burn through if the film is too thin, or the laser is not specified correctly. In this situation, laser-sensitive coating can be a good solution as it requires low power to achieve the mark, reducing the risk of burn through.
- **Biaxially-Oriented Polypropylene (BOPP)** films have become popular due to a unique combination of properties such as better shrinkage, stiffness, transparency, seal-ability and twist retention. BOPP is typically very thin (commonly used for chocolate bars) and therefore also has a potential risk of burn through. A 9.3 wavelength is generally recommended by Videojet, as it gives a quality marking result without penetrating the substrate too deeply.

Videojet provide two different fonts to help avoid burn through

1. Lacuna – non-crossing font helps avoid material weakening by creating characters without hitting the same point on the substrate twice. Using this font can increase mark time but not significantly.
2. Dot font – uses only dots to form characters, again minimising the potential for the laser beam to hit the same spot more than once.

Pouches

Pouches typically suit a colour change mark result as the products packaged within a pouch tend to be high-quality, branded goods that use colourful designs. By removing the outer layer of colour, the result is a crisp, high-contrast code that can work in synergy with the brand.

Cables/tubes/hoses (extruded plastics)

PVC reacts with CO_2 to produce an engraved effect with colour change, which can often result in an attractive golden mark.

Mark speeds:

Typically up to 100,000 products per hour
(throughput is material dependent)

Best wavelength:

PVC – 10.6µm

BOPP films – 9.3µm

All other plastic materials – 10.6µm

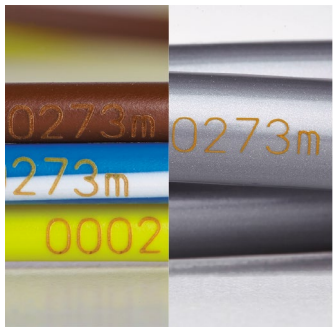
Colour change to blister pack

Colour removed on bottle

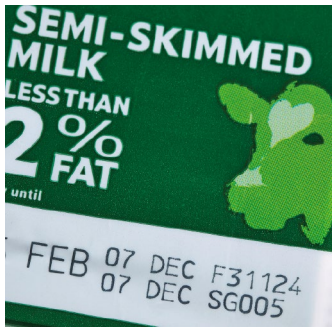
Expiration code

Colour removal on green foil

Engraving to PVC pipe



Colour change on wire



Expiration code

Colour change on laser-sensitive coating of dairy carton film sleeve

PET

Typical coding requirements:

It is becoming increasingly common for producers of PET packaging to use 'thin walled' PET in an attempt to reduce cost and waste. This can present challenges for laser marking as the thin substrate opens up the risk of burn through. Choosing the right wavelength can resolve this issue by producing an alternative mark effect. Another requirement for PET is the ability to print at high speeds as most applications are high-speed beverage marking alphanumeric expiry date and lot information.

Marking effects:

- **Engraving**

  Foaming – best mark result for 'thin walled' PET

  Engraving – suited to thicker PET materials

Mark speeds:

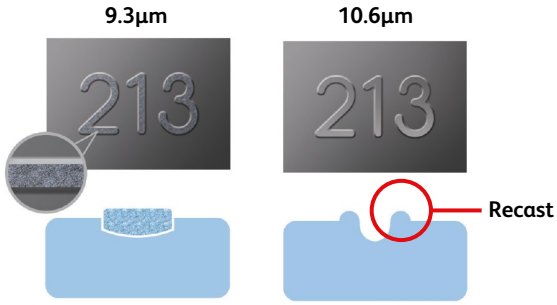
Typical speed 70,000 – 150,000 bottles per hour

(message and substrate dependent)

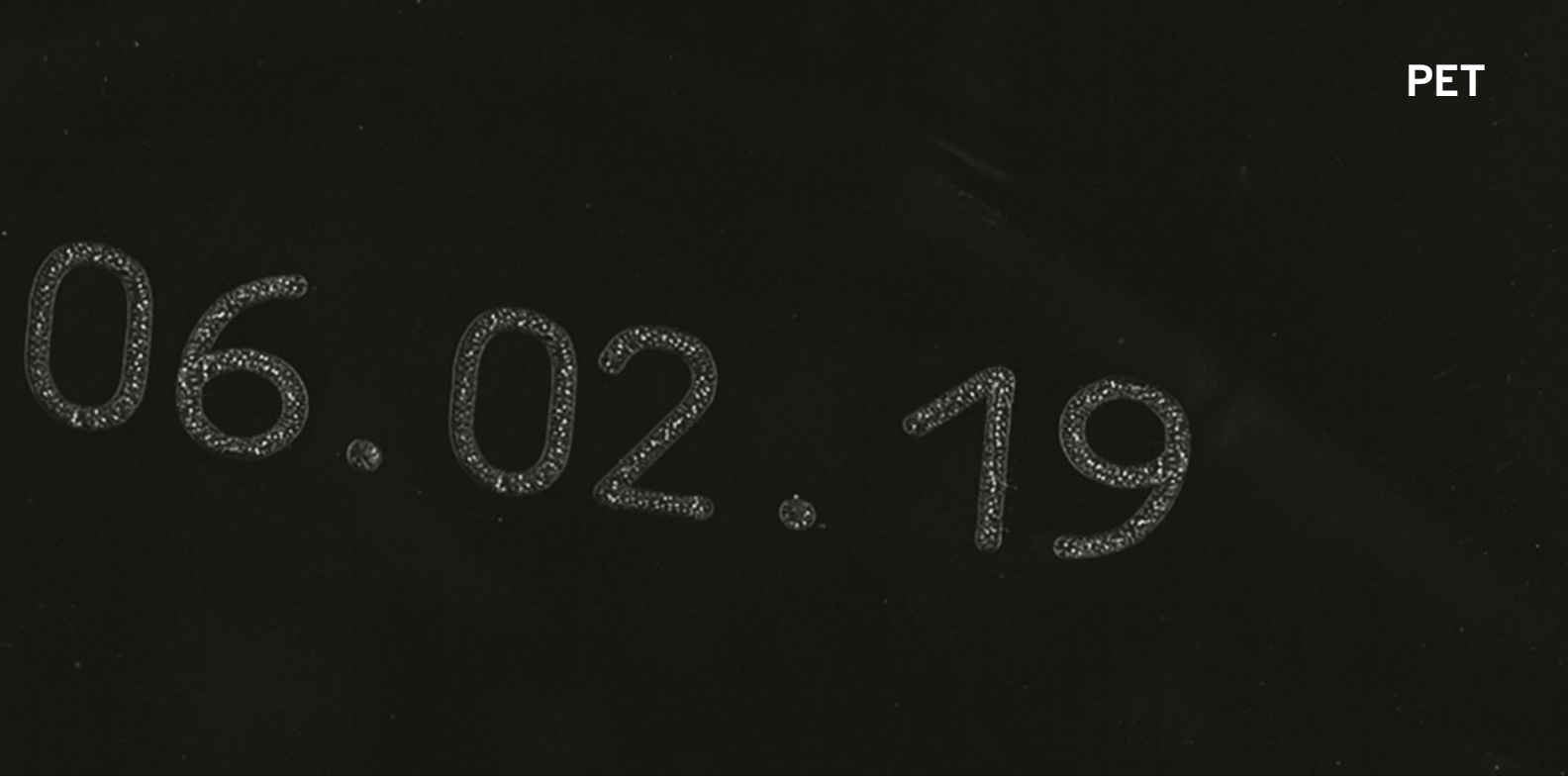
Best wavelength:

9.3µm – specifically developed for PET plastics

Example of why wavelength is critical for PET:



Using a 9.3µm wavelength achieves a 'foaming' effect of the material, which means no surface material is removed in the process, thus not reducing the strength of the material. Conversely, using 10.6µm results in a deeper engraving effect, making it ideally suited to thicker PET.



Two line date code on plastic PET

One line date code on plastic PET

Glass

Typical coding requirements:

CO_2 laser marking on glass is typically suited to marking serial numbers, internal tracking numbers and traceability information and can be applied to white or coloured glass. 2D codes are less common, although are achievable with the right spot size. A small spot size is recommended for marking glass to achieve a smooth marking finish. Using a large spot size could potentially produce a micro fracture that is too large and therefore rough to the touch.

Marking effects:

Micro cracks/fracturing that etches into the glass surface

Mark speeds:

Typical speeds up to 80 metres/min or 60,000 bottles per hour (substrate dependent)

Best wavelength:

10.6µm – when used in collaboration with the right marking head and lens, this will provide a fine, smooth mark effect on glass

Logo detail on glass

Lot code on glass

Coated Metals

Typical coding requirements:

CO_2 lasers suit two main types of metal materials: painted metal and anodized aluminium. Typical applications require logos and/or alphanumerical characters, such as lot and batch numbers. High-quality DataMatrix codes can also be achieved when marked on anodized aluminium. Painted metal can present a challenge for CO_2 lasers if the coated layer is too thick. Higher laser power or a slower line speed may be required to achieve the desired mark effect.

Marking effects:

- Colour change – anodized aluminium
- Colour removal – painted metal surfaces

Mark speeds:

Typical logo (anodized) – 1-2 seconds
(depending on code, lens and spot size and substrate)

Typical DataMatrix code (anodized) – 0.5 seconds

Alphanumeric code on anodized and painted metal – 10ms

Best wavelength:

10.6µm

Colour removal of date on metal

Colour removal of DataMatrix code on metal

Videojet CO_2 lasers can handle a variety of applications, from simple date coding to printing larger, more complex messages

Videojet CO_2 lasers not only deliver high-quality marks on a wide range of substrates, but their inherent vector-based marking also enables a level of printing resolution far superior to other coding technologies. This opens up a range of marking opportunities including logos, bar codes, global alphabets, and true type and laser optimised fonts.

Bar codes

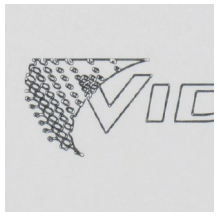
Due to high mark quality and the potential for high-contrast marks, laser marked bar codes can achieve very high bar code grades with excellent readability. Videojet CO_2 lasers can mark a range of symbologies including linear bar codes such as GS1-128 and 2D symbologies including GS1 DataMatrix codes.
In addition, the very nature of the laser marking process creates an inherent permanence to the bar code, which can aid traceability efforts. This permanent mark resists abrasion and other effects that could alter the readability of the code.

Logos

There are normally four reasons why a customer asks for laser marking of logos;

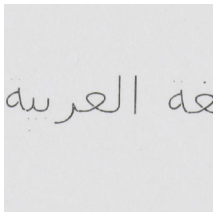
1. Legal requirement
2. User information
3. Sales information
4. Brand protection

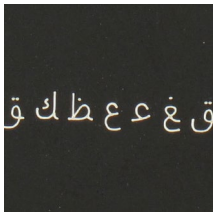
Laser marking helps protect against brand piracy and brand abuse by applying permanent marks to the product. This supports anti-counterfeiting and also produces an easily-traced marking to offer additional security and brand protection.



Global alphabets

Videojet CO_2 lasers mark in over 20 languages, including Arabic, Chinese, Hebrew, Turkish and Bengali, to provide flexibility for producers who may export many different product types globally.





True type fonts (TTF)

TTF capability allows customers to mark their product using any type of common font, and can be marked in any languages. Commonly handled as artwork files, TTF fonts offer the advantage of using a font that complements the brand or packaging design.

Single stroke laser-optimised

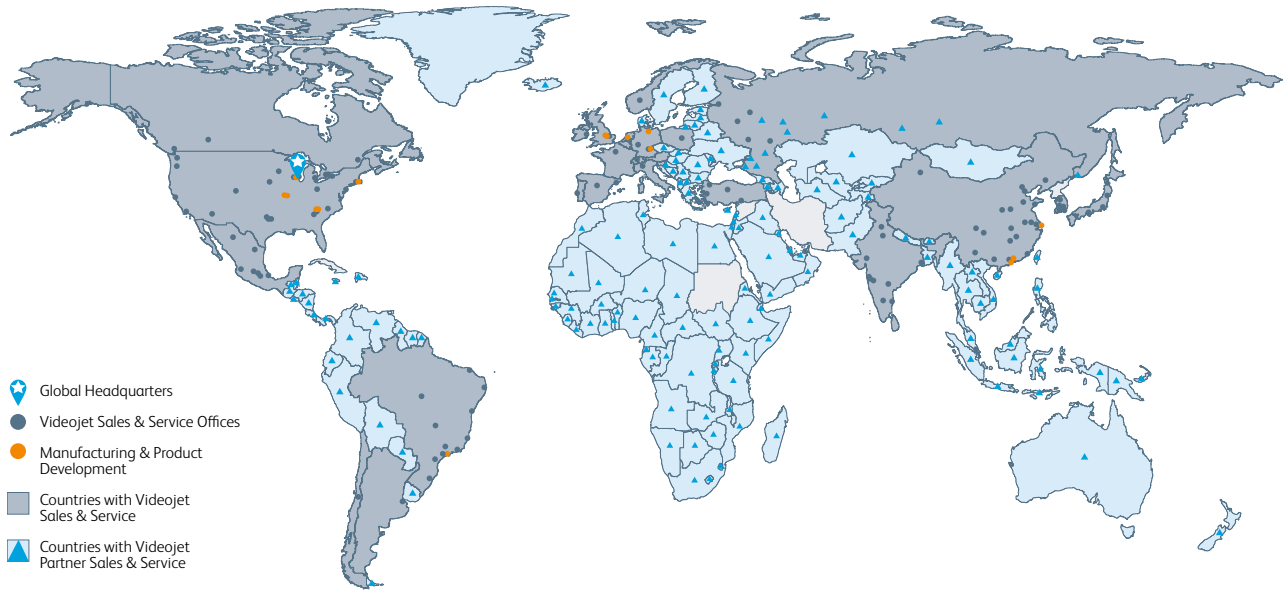
Single stroke fonts are specifically designed to be faster to mark compared to other, more traditional fonts. These clean, modern fonts are often selected when either the available mark time is short due to the speed of the packaging line or the amount or required content to mark is very high.

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 Inkjet (CIJ), Thermal Inkjet (TIJ), Laser Marking, Thermal Transfer Overprinting (TTO), case coding and labelling, and wide array printing, Videojet has more than 345,000 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 4,000 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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