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VEROTEC
Electronic Enclosures
A MEMBER OF POLYRACK

# MARKING TECHNOLOGIES

Efficient marking – Our technologies in comparison

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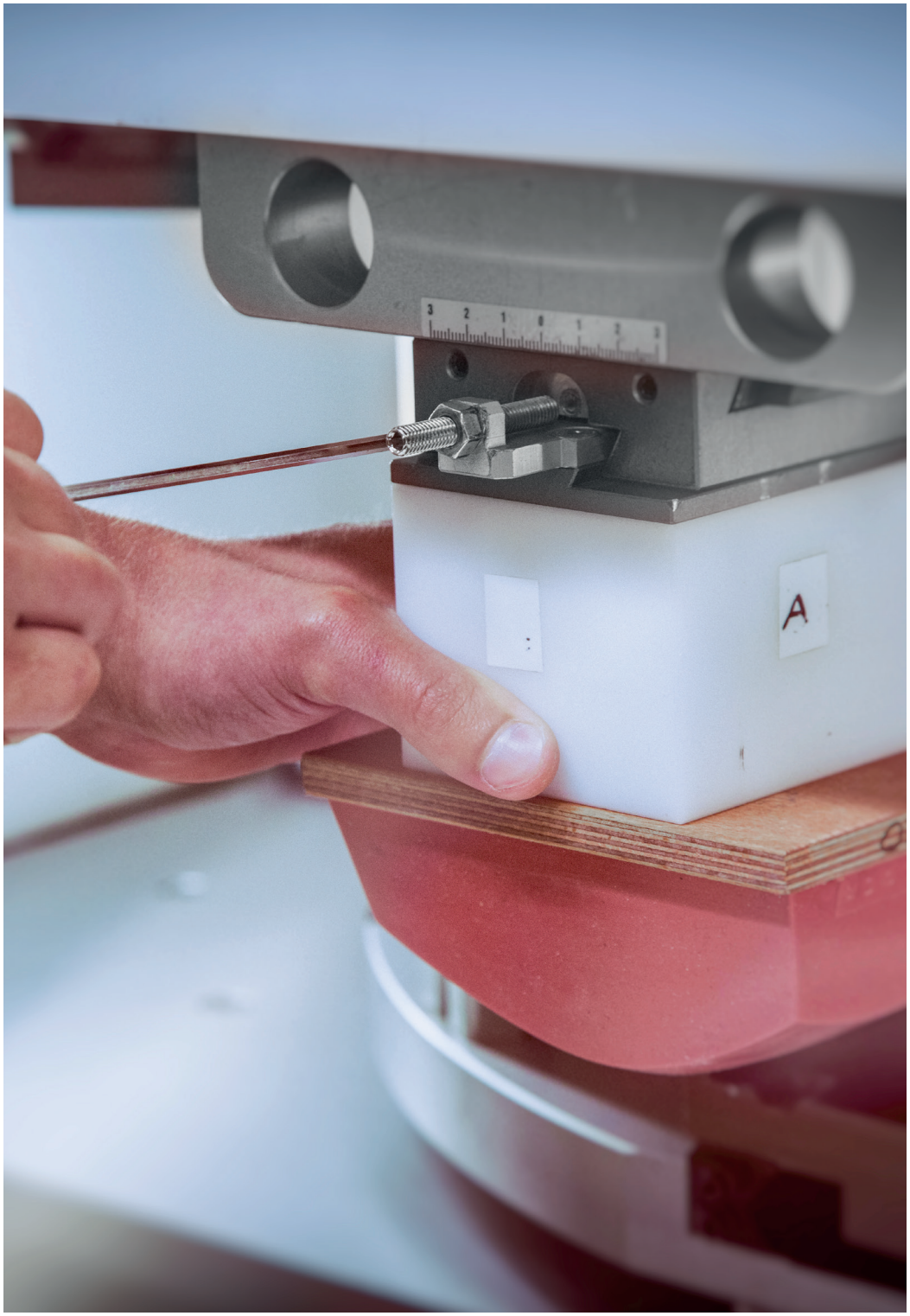
## INTRODUCTION

Selecting the appropriate marking technology is crucial for the quality, sustainability, and efficiency of your product marking. Whether pad printing, inkjet, silk screen printing, laser marking, or a combination of printing and laser—each technology has its specific strengths, requirements, and areas of application.

The most suitable method depends on various factors: the material of the product, the surface finish, the required sustainability and quality standards, the quantity, and the individual design requirements. There is no blanket answer for a solution - the decision must be precisely tailored to the dedicated application.

In practice, this means that a thorough analysis of the component, material, printing or marking specifications, and production conditions are essential in order to develop an economical, reproducible, and high-quality marking solution. Using the right technology not only optimizes appearance and sustainability but also results in efficient processes and reduced costs.



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## THE FEATURES OF THE TECHNOLOGIES

### PAD PRINTING

Pad printing has several unique features that make it an extremely flexible method for product marking and printing:

**Printing on complex geometries**
One of the main strengths of pad printing is its ability to print accurately on uneven, curved, textured, or very small surfaces. The flexible silicone pad adapts to almost any shape.

**High detail accuracy**
Thin lines, small fonts, and delicate logos can be reproduced with high precision—ideal for technical components, electronics, or medical products.

**Wide range of materials**
Pad printing is suitable for a wide variety of materials such as plastics, metals, glass, ceramics, and painted or coated surfaces.

**High process reliability in series production**
The technology is extremely stable and reproducible, making it ideal for medium to large quantities.

**Multicolor printing possible**
Multicolor designs can also be precisely reproduced using multi-step printing processes.

**High resistance**
The prints are abrasion-resistant and resistant to chemicals and natural elements with the right choice of colors and pre-treatment.

**Cost-effectiveness**
Set-up times and printing costs are comparatively low, and therefore pad printing is considered a cost-effective process, even for series production.

***Conclusion: Pad printing is always the right choice at the moment complex shapes, high print quality, and reliable series processes are required.***

## LASER MARKING

Laser marking offers numerous special features that make it a modern and extremely precise technology for product marking:

**Permanent and tamper-proof marking**
Laser markings are directly engraved into the material rather than applied to its surface and are therefore abrasion-resistant and resistant to heat, chemicals, and UV light.

**High precision and detailed accuracy**
Even the finest structures, micro-lettering, barcodes, data matrix codes, and serial numbers can be marked with exceptional clarity.

**Touchless process**
Marking is performed without contact, which means that there is no mechanical damage, and even sensitive components can be marked gently.

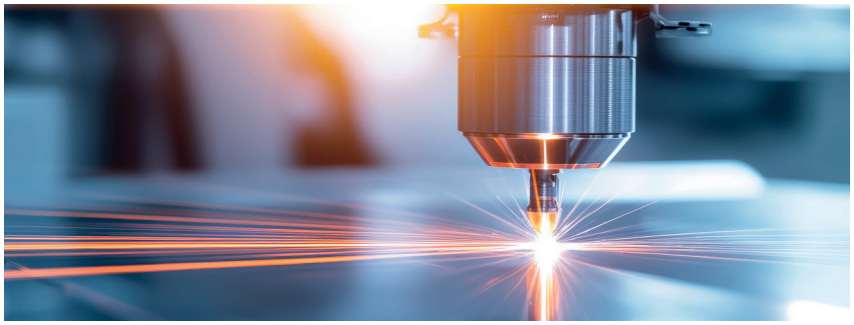
**No consumables**
Unlike printing processes, no inks, solvents, or printing plates are required, which reduces running costs and is considered environmentally friendly.

**High process speed and automatability**
Laser marking systems can be easily integrated into automated production lines and enable short cycle times.

**Marking effects dependent on choice of materials**
Depending on the material, different effects such as engraving, annealing, foaming, or color change, opening up a wide range of design options.

**Traceability made easy**
Laser marking is ideal for traceability applications in industries such as automotive, medical technology, and electronics.

***Conclusion: Laser marking is the preferred solution at the moment permanent, precise, and low-maintenance markings are required—especially once high-quality and traceability standards are demanded.***



## PRINT-LASER COMBINATION

The joint laser-printing process combines the advantages of conventional printing methods (e.g., pad printing or inkjet) with the precision and permanency of laser marking. The results are highly flexible, permanent, and high-quality marking solutions. Following are the details:

**Unlimited freedom of design**
The combination allows colored logos, text, or graphics to be printed while also adding fine, permanent laser engravings—ideal for high-quality products with branding or security markings.

**Combination of permanence and flexibility**
The laser ensures permanent, abrasion- and chemical-resistant markings, while printing allows for variable, colored, or detailed designs.

**Efficient series production**
The combination can group process steps, especially for complex applications: e.g., first laser engraving for precise codes, then printing for visual marking or branding.

**High precision on complex geometries**
Laser and pad/inkjet complement each other, allowing uneven or textured surfaces to be marked precisely and aesthetically.

**Higher security and tamper protection**
Combining color printing and laser engraving makes it harder to manipulate or tamper with the markings.

**Reduction of refurbishment and sources of error**
The combination minimizes set-up times and reduces sources of error between separate printing and laser processes.

**Wide range of material adaptation**
The process can be optimized for each material, and therefore the technology is suitable for plastics, metals, glass, ceramics, and coated surfaces.

***Conclusion: The combination of printing and laser technology offers the perfect symbiosis of individuality, precision, and sustainability. It is particularly suitable for products that ask for high-quality appearance, variable data, and permanent marking at the same time—e.g., in medical technology, electronics, or the automotive industry.***

## INJEKT

The inkjet printing process (often referred to as “inkjet printing”) also has some extraordinary features that make it very appreciable for product labeling:

**Touchless printing**
The process is applied without contact, similar to laser printing, which means that sensitive surfaces or complex shaped products are not damaged.

**High flexibility in design**
Text, graphics, barcodes, data matrix codes, or serial numbers can be applied variably and individually directly to the product—ideal for batch or personalized labeling.

**Fast conversion and adaptation**
Modifications to the final print design (e.g., batch numbers, expiration dates, serial numbers) can be implemented directly in digital form without the need for new tools or print screens.

**Wide range of materials**
Inkjet works on plastics, metals, glass, cardboard, foils, and coated surfaces—depending on the type of ink and surface.

**High printing speed**
The print heads allow high (running) speeds and are therefore especially suitable for continuous production lines or large quantities.

**Variable drop size and resolution**
Precise control of ink droplets allows for fine details and high resolutions.

**Requires no tools**
Unlike other printing methods, screens or pads are not required and result in reduced set-up cycles and costs for small batch sizes.

**Use for temporary or changing labels**
Inkjet is ideal for flexible or temporary printing, e.g., for best-before dates, batch codes, or serial numbers.

***Conclusion: Inkjet printing is particularly suitable at the moment variable, digital, and easily adaptable markings are required on different materials and is also suitable for high volumes or small batches.***

## SILK SCREEN PRINTING

Silk screen printing is a classic printing technology that offers certain unique advantages, particularly in product labeling and printing. Here are the most important features:

**High color intensity and opacity**
Silk screen printing enables vibrant, opaque colors, even on dark or transparent materials. This makes it ideal for logos, markings, or decorative elements.

**Thick layers of ink are possible**
Unlike pad or inkjet printing, thicker layers of ink can be applied, which is, for example, useful for haptic effects or particularly long-lasting prints.

**Wide selection of materials**
Silk screen printing works on plastics, metals, glass, ceramics, wood, paper, and textiles, making it very versatile.

**Weather and chemical resistance**
The print quality is decisive, depending on the choice of ink for a very robust, abrasion-resistant, UV-resistant, and against solvent- and cleaning product.

**Decorative and functional effects**
Silk screen printing allows processing large, straight areas or repeating patterns, contrary to pad printing.

**Suitable for large areas and repeating patterns**
Unlike pad printing, large, straight areas or repeating patterns can be printed efficiently.

**Cost-effectiveness for medium to large quantities**
The process is particularly efficient if consistent quality is required across many products.

***Conclusion: Silk screen printing is ideal at the moment bright colors, large surfaces, decorative effects, or thick layers are required. It complements other processes such as pad printing, inkjet, or laser if the aim is for visual impact and stability.***

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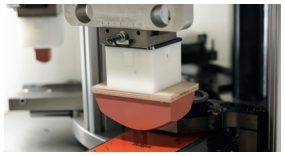
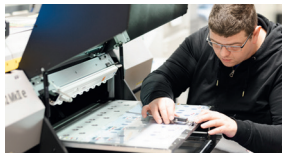
## CHARACTERISTICS OF THE TECHNOLOGIES



| PAD PRINTING | |
|---|---|
| Colored marking | +++ |
| Permanent marking | +++ |
| Set-up | ++ |
| Format change | ++ |
| Customization | + |
| Ink types | +++ |


| LASER MARKING | |
|---|---|
| Colored marking | + |
| Permanent marking | +++ |
| Set-up | +++ |
| Format change | +++ |
| Customization | +++ |
| Ink types | + |

| PRINT-LASER | |
|---|---|
| Colored marking | +++ |
| Permanent marking | +++ |
| Set-up | ++ |
| Format change | ++ |
| Customization | +++ |
| Ink types | +++ |



| INJEKT | |
|---|---|
| Colored marking | +++ |
| Permanent marking | +++ |
| Set-up | +++ |
| Format change | +++ |
| Customization | +++ |
| Ink types | +++ |

| SILK SCREEN PRINTING | |
|---|---|
| Colored marking | +++ |
| Permanent marking | +++ |
| Set-up | +++ |
| Format change | +++ |
| Customization | +++ |
| Ink types | +++ |

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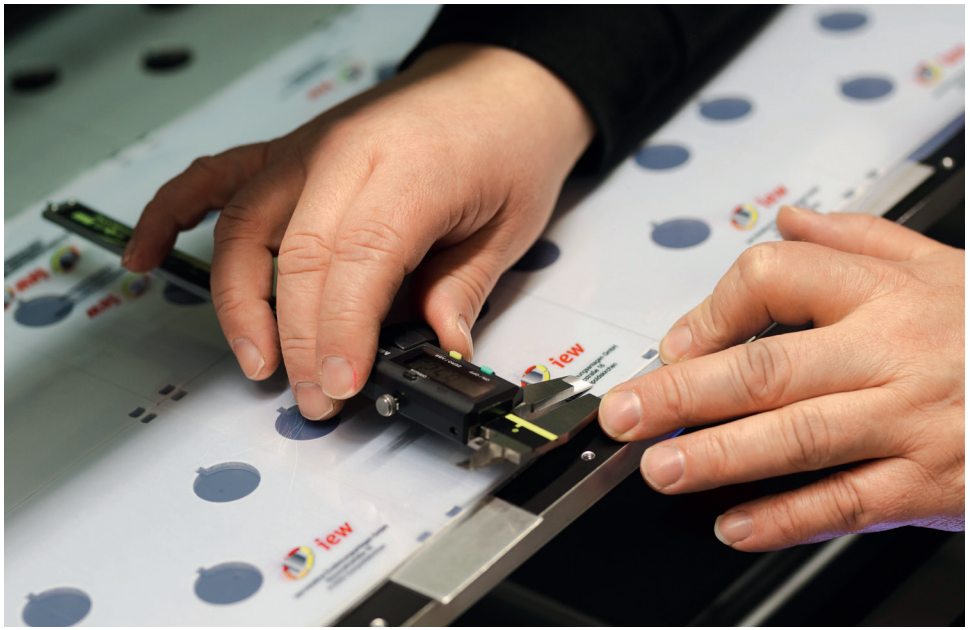
## OUR SERVICES - FEASIBILITY ANALYSIS AND SAMPLING

Our Application Engineering department performs on the technical feasibility of your marking process and carefully analyzes the component, material, and quality requirements. Based on the aforementioned, we develop a cost-effective and process-reliable procedure, keeping all relevant elements and aspects under consideration. This allows us to define the optimal method for reproducible production, regardless of whether the choice for silk screen printing, pad printing, laser, or inkjet processes is required.

Our range of services includes:

- Determining the favored synergy of all elements and aspects
- Support with set-up, parameterization, and test runs
- Process optimization of existing production facilities
- Technical consulting by experts in pad printing, silk screen printing, laser, and inkjet



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## SURFACE TREATMENT AND FINISHING

Your products receive the indispensable final touch through the surface finishing in order to meet both visual and technical requirements. POLYRACK offers a wide range of treatments for this purpose—from decorative surfaces to functional protective measures.

**Powder coating & wet painting**

Powder coating and wet painting will be matched with your individual requirements for a perfect finish result. The choice of color can be selected from the RAL color chart to comply with your design aspects. Various gloss levels (matte, silk gloss, glossy) and surface structures (smooth, fine structure, growth texture) offer maximum flexibility. POLYRACK has its own facilities for manual and fully automated powder coating, while wet painting complements the range for smaller batch sizes or special requirements.

**Galvanizing & Chromating**

Functional galvanizing technology enables metallic coatings that provide corrosion and wear protection while improving electrical conductivity.
Chromating (chrome(VI)-free passivation) of aluminum is a proven practice, in particular in the electronics and aerospace industries. The processes offer high corrosion protection, low abrasion resistance, thin layer thicknesses, a homogeneous surface appearance, electrical conductivity, and solderability. The colorless passivation is also generally applied as an adhesion promoter for subsequent powder coatings or paint finishes.

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## CONCLUSION

Selecting the appropriate marking technology depends on the material, shape, quantity, and sustainability – there is no blanket answer to point to a solution. Pad printing impresses with its precision on complex geometries and is particularly suitable for small to medium series. Inkjet printing offers maximum flexibility, quick adjustments, and the ability to implement individual markings directly on the production line. Silk screen printing scores with bright colors, thick layers of ink, and decorative effects on large surfaces. Laser marking delivers permanent, abrasion-resistant, and highly precise markings, while the combination of printing and laser combines the advantages of both processes: colorful design and tamper-proof, permanent labeling.

Our experts at POLYRACK evaluate components, materials, and requirements; select the optimal process; and ensure that your products are marked in a reproducible, high-quality manner that is both functional and visually perfect.

**Are you aiming for a new project, and would you like to discuss a possible production concept in person?**
**The POLYRACK TECH-GROUP team of experts will be happy to provide you with a non-binding initial consultation.**

## YOUR CONTACT


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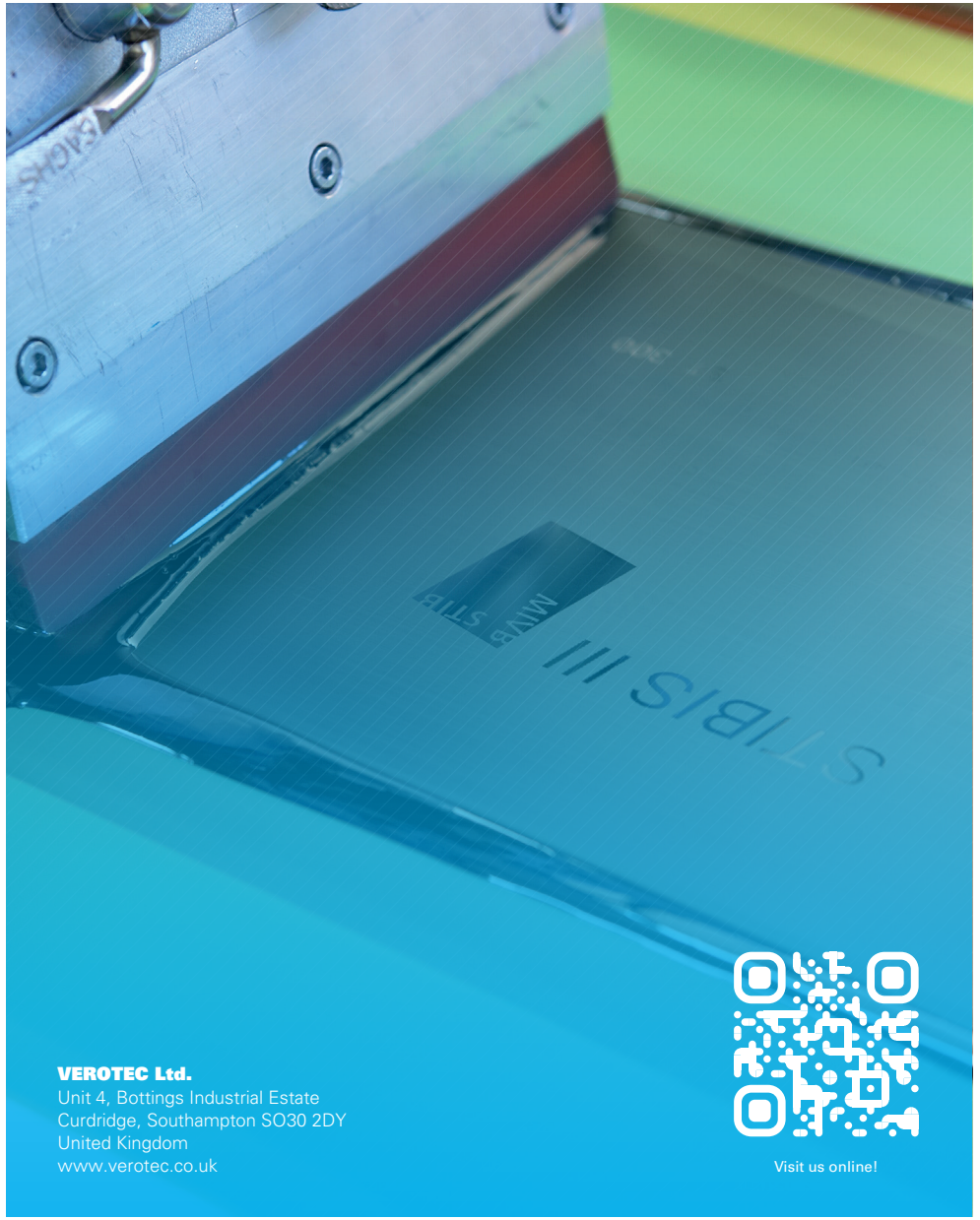


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