



DIRECT PART MARKING: MORE THAN JUST A CODE ON A SURFACE

DPM TECHNOLOGY

Direct Part Marking (DPM) is a process for imprinting a bar code directly on an item or surface in a permanent manner instead of printing the code on a paper label that is adhered or attached to a surface. The intent is to create a permanent identifier for the item. In most applications, 2D bar codes are used in DPM technology.

The use of DPM technology is becoming increasingly popular in many applications as manufacturers are required to trace their products from beginning to end throughout the supply chain. This tracking ability needs to endure regardless of the size of the bar code, the surface material involved, or where a component might be shipped to on a global basis.

The main benefit of DPM technology is its durability. The permanent nature of the marking assures that the item can be identified throughout its full life cycle and throughout the supply chain, even while being exposed to harsh environmental conditions. Under such conditions, traditional codes printed on a label could not endure.

In many cases, bar codes marked with DPM technology are used to identify and track unique items such as spare parts or components. Another important benefit of DPM technology is that it allows the marking of very small codes in limited spaces where a standard label cannot be applied in a reliable and stable mode.

The high variability of the surface material (metal, plastic, glass, etc.) and the reduced size of the codes marked with DPM offer unique challenges to the device used to read the bar codes. For DPM technology to be successful in providing traceability and increased operational efficiency, multiple factors need to be considered before choosing DPM technology as the right solution for lifetime product traceability.

DPM APPLICATIONS

Direct Part Marking is a technology that can be suitable for various industries. While the use of bar codes marked with DPM technology were first adopted by the automotive sector, its popularity has spread to aerospace, defense, electronics and computers, healthcare, raw materials,

jewelry and more. Bar codes marked with DPM can be implemented on different surfaces and materials including plastic, metal, wood, rubber, leather, glass, etc. The use of 2D codes provides the capacity to encode a large amount of data in a very limited space.

Indeed, manufacturers use DPM technology to enhance the supply chain traceability of car components, medical tools, weapons and defense equipment, fine jewelry, electronic parts or any application where there is the need to experience harsh chemical treatment, endure extreme conditions of moisture or temperature, include high-value assets or items that need to be identified throughout their lifetime.

User safety is increasingly a key factor for the use of DPM technology. It is absolutely fundamental in healthcare and some applications in the aerospace industry. The precise traceability of surgical tools or implants is driving the use of DPM technology in medical environments. Inaccurate control of tool usage and sterilization processes can compromise patient safety. DPM technology is the

only marking method capable of meeting the demanding life and reliability requirements in medical environments where codes must be resistant to high temperatures and corrosive agents used for sterilization as well as the wear and tear caused by normal operational use.

FROM COMPLIANCES TO CODES

Several industries have compliance requirements in terms of parts identification including: automotive (AIAG B11), aerospace (ATA Spec 2000), medical (FDA Unique Item Identification) and defense (DoD Unique Item Identification). These industries have selected the 2D 'Data Matrix' symbology as their bar code of choice.

Data Matrix is a 2D code of black and white modules that can store up to 2,335 alphanumeric characters. The symbol is square or rectangular and can range from 0.0004 inch per side up to 14 inches per side. The data encoded can include the manufacturer ID, part number and a unique serial number.

This 2D code is becoming an industry standard because it offers several benefits including:

- Large data storage capacity
- Minimal marking area
- Good reading resistance to quality degradation
- Built-in error correction
- Compatible with direct marking methods

The size and shape of the 2D codes will vary with the surface and the shape of the item being marked.

DIFFERENT MARKING TECHNOLOGIES DOT PEENING

There are multiple methods for directly marking objects:

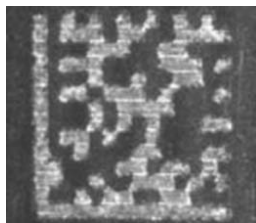
- Laser etching
- Chemical etching
- Dot peening
- Ink jet printing

Each of these methods has specific advantages and disadvantages in terms of durability, cost and ease of reading.

Laser etching is the most widely used method because it is applicable to many different materials while offering superior marking qualities. This technique does not involve the use of inks, nor does it involve tool bits which contact the engraving surface. However, before opting for laser technology, one should pay attention to the material in question.

LASER ETCHING

Laser etching will affect the material being marked creating a change of the material characteristics through the interaction with a laser beam. By turning the laser on and off, the laser beam draws or etches the bar code on the surface of the material. Depending on the laser strength, the surface changes are affected by ablation, engraving, color change, annealing or surface oxidation.

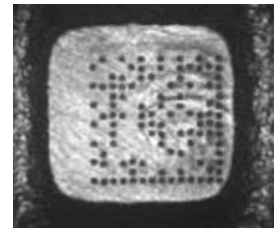


CHEMICAL ETCHING

Chemical etching requires masking to limit the affected area. In some situations, chemical etching may require extra manufacturing processes to apply the mask, etch the code, and remove the mask.

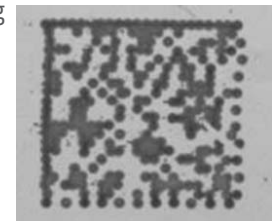


Dot peening, also known as point of percussion technology, consists of a series of mechanical percussions done by a machine and a needle called 'peen'. Impressions are made at specific locations modifying the depth of the surface which creates differences in the light reflection and diffusion which is needed to identify light and dark elements of the symbol. This technology is particularly used in the automotive sector because it is the most durable solution.



INK JET PRINTING

Ink jet printing consists of projecting ink onto the surface of the items, producing a pattern of spots constituting the code by ink deposit. While this process is not suitable for harsh environments, the advantage of this technology is that it can be used on all types of surfaces and eliminates the need for a paper label.



DPM READABILITY

Many elements must be considered when opting for DPM technology which impact the readability of bar codes. Foremost is the marked surface. In DPM technology, the marked surface is the code background, one of the most crucial factors for bar code readability. The code background normally defines the contrast that can be achieved to discriminate between marked and unmarked areas. When using the laser etching technology, it is possible to make the marking process in 2 steps: a first pass to prepare a



suitable background, and a second pass to create the bar code itself. These 2 steps require more time, consequently it is a more expensive process to use, but it is mandatory when a surface is considered unusable.

Another key factor is the location and size of the area for the code. This can impact the quality of the code produced, the code contrast, the respect of the code quiet zone and more. The shape of the surface (flat or rounded) can impact the readability by causing reflection or distortion of the bar code.

Often users tend to think their bar code reading difficulties come from the inadequacy of the bar code readers. In many cases, reading problems can stem from the poor quality of the code marking as a result of a poor choice made in marking technology, code placement, code size, environmental effects and base material understanding. A detailed analysis of the above key factors and the correct combination of materials, marking technology, code size and placement is the first step in producing a reliable and effective marking solution.

The second step is the selection of the bar code reader. Datalogic ADC has a family of scanners able to satisfy and meet the needs of the customer by offering the most appropriate solution at the appropriate price.

The PowerScan™ imagers (PD9530-DPM and PD8590-DPM) were designed specifically for use in DPM applications where environments are harsh and use can be rugged. The PowerScan imagers have these features:

- Snappy omnidirectional reading
- Optics for high resolution bar code reading capability
- New instinctive aimer
- New 'soft white light' illumination
- Water and Particulate Sealing Rating: IP65 (PD9530-DPM)
- Ergonomic shape for hours of tireless use
- Multi Axis lighting technology for harshest code on rough surfaces (PD8590-DPM)

SUMMARY

Most implementations of DPM technology stem from the need to track components and materials from one end of the supply chain to the other and throughout the life of a particular item. These implementations are often the result of mandated government or industry regulations where personal safety must be assured. Therefore the marking of a bar code on a component should be given careful consideration to assure it lasts, regardless of the environment it is exposed to.

Successful Direct Part Marking (DPM) is a combination of many factors including:

- Marking technology
- Surface material
- Surface shape
- Environmental effects on the code
- Code size
- Symbology
- Bar code reader

Balancing the product factors, the marking technology and providing a scanning device designed for the application is the only way to assure the benefits of DPM technology.

Datalogic is a worldwide leader in manufacturing technology to read bar codes permanently marked with DPM technology. Datalogic's PowerScan DPM imagers are ideally suited for DPM applications. For more information on DPM technology, please contact Datalogic.





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