ARC BRIEF

JUNE 2006

Direct Part Marking at Ford Motor Company

By Steve Banker

Keywords

Direct Part Marking

Summary

Manufacturers see an increasing need to address full life cycle traceability. In certain industries, leading companies are marking 2D codes directly onto parts. Direct Part Mark identification offers the ability to track monitor and manage parts that range in value and size. Many implementations require mobile devices, in addition to stationary readers, to track components. This Brief discusses the advantages of Direct Part Marking, the value of DPM mobile devices, and Ford Motor Company's program in this area.

Cradle to grave traceability allows manufacturers to improve product quality, improve supplier compliance to quality standards, and makes it easier and less expensive to engage in product recalls. Direct Part Marking is one technology that allows manufacturers to address full life cycle traceability.

Analysis

In the first section, Direct Part Marking will be discussed. In the second section, a case study of Ford Motor Company's DPM program is provided.

Direct Part Marking

Being able to track a product, and the key components that it is made of, from manufacturing throughout the supply chain, and from product birth to product retirement, offers manufacturers many advantages. With DPM, manufacturers have the data necessary to improve product quality and production processes; improve supplier compliance to quality standards; and if the worst does happen, and a product recall must occur, that process becomes much easier and less expensive.

Traditional bar code labels do not support lifecycle tracking. They can fall off or become unreadable over time. In contrast, by directly marking a part with a laser, through chemical etching, or by stamping the part (called dot peening), the component can be traced through its entire lifespan.

DPM applications usually use a 2D Datamatrix symbology. 2D carries more information than 1D bar code symbologies, and DPM with 2D can be put on much smaller surfaces than 1D bar code labels. However, directly marked parts can be more challenging to read than traditional 1D barcodes.

In most DPM implementations, there are machines that directly stamp or etch the symbol onto the part, high-end vision machines that are used to grade the quality of the mark for readability, and other downstream stations and mobile readers to gather the part identifications in order to support a variety of operational processes, as well as collecting the information for end to end traceability.

Part with 2D Direct Part Mark

The Ford Case Study

Ford began their Direct Part Marking program three years ago. This was part of a larger quality and continuous improvement initiative at Ford and the program was approved to contribute to those initiatives, rather than on the basis of a ROI analysis. In truth, the two main drivers for this project - improving the quality of their finished products and stopping large recalls - are benefit areas that are extremely difficult to quantify financially.

Ford also recognized that DPM would help support flexible manufacturing. Ford assembles multiple products on the same line. Parts that are virtually indistinguishable to the naked eye are used. In the past, Ford used colored

dots or labels on these components. Now DPM is used to complement the traditional methodology, which provides for more robust error proofing.

In order to achieve end to end traceability, Ford has asked suppliers of key Powertrain components to directly mark their components. Most have chosen to use either dot peening or laser etching to comply. Some components, however, are too small even for DPM (a surface can be as small as one quarter of an inch by one quarter of an inch and still support DPM). For these suppliers, Ford has asked them to ship goods in a container marked with the 2D PDF 417 symbology. Information contained in the shipping label can than be used at receiving to verify that the right components were shipped and that they were shipped in the right quantities.

Ford has four principles at the core of its traceability program. Their goals are to:

- Collect and Preserve Data - The process owner, Ford or the supplier depending upon who creates the part, owns the data and is responsible for archiving that data. Readers only need capture the minimum amount of data necessary to preserve the integrity of the traceability process. That means most parts can be tracked with lot numbers rather than individual serial numbers.

- Ensure Process Robustness - Whoever creates the identification mark must verify read performance based on quality, content and read rate specifications at all read stations. If a supplier marks a part, the mark's quality is to be kept to a minimum grade of a "C" as specified by ISO While a "D" grade may be read by a downstream process, it usually indicates that the marking machinery needs maintenance and should be corrected before downstream read failures occur.

- Use Common Standards - The goal is to write once but to be able to read the part mark many times. It is important to remember that like parts may be cross shipped among different Powertrain plants, so universal standards are necessary, as well as a common process for reading parts.

- Add Value, Reduce Cost - Parts should be marked as early in a process as practical. The longer the value stream a part can be read in, the more value the traceability process has for everyone.

Ford emphasizes that effectively using DPM is a journey. When they began, they had unacceptable read performance. With time they learned many things. For example, they learned that reading a dot peen mark on cast aluminum was difficult, better results with this surface can be achieved with laser etching; that it is difficult to read marks on curved surfaces; and that if marks are read in natural daylight (which varies in intensity) fixed camera's require additional setup.

They also found that they were supporting one type of scanner for 1D, one for PDF, and others for DPM was onerous. Finally, they found stationary scanners attached to lap top computers were not providing them with enough mobility and limiting the applications where they could use DPM.

Two years ago Ford met Freedom Technologies at an industry event and Freedom demonstrated the Symbol MC 3090 mobile computer (with built in reader) could reliably read a variety of marks on a variety of surfaces and could serve as multi-application mobile reader. Freedom went on to develop two custom applications for Ford. The first application decodes the PDF 417 label and verifies the content of the shipment. Ford points out that this sounds simple, but for technical reasons decoding 2D symbologies is not simple. Secondly, Freedom developed a solution for locating DPM parts out on the floor. This solution integrates to the Ford Quality database and downloads into the device the serial numbers of components of suspect quality. Ford personnel can then use this application to find and verify that all suspect components have been put in quarantine.

Early adopter industries for DPM include the automotive industry, the Defense industry (because of a US Department of Defense mandate), the Aerospace industry, and the medical device industry.

Ford started small, the initial beta test was with 15 units. However, the Freedom/Symbol solution quickly proved itself. Ford is now deploying an average of 15 units per facility across more than 5 plants. DPM, and these mobile readers, will also be used with every new program launch.

Recommendations

- If you decide to go forward with DPM, visit locations and talk to people using the equipment. There is a big difference in how this equipment may perform in the lab versus a production environment.

- Incorporate DPM into product design. Have suppliers leave a flat surface of requisite size to which a mark can be applied.

- Use mobile devices. These are particularly helpful with direct part mark and shipping label applications.

- Recognize that the ultimate value of DPM is for lifetime part tracking. Move steadily toward tracking parts through their complete lifecycle.

For further information or to provide feedback on this Insight, please contact your account manager or the author at sbanker@arcweb.com. *ARC Insights are published and copyrighted by ARC Advisory Group. The information is proprietary to ARC and no part of it may be reproduced without prior permission from ARC.*