Marking of products and transportation units – information contents and marking technologies

Alexander Johannesson
Ivan Rimac

Department of Industrial Management and Logistics
Lund University, Faculty of Engineering
SE-221 00 Lund, Sweden

This document is an article based on a master thesis work conducted during summer and fall of 2009. The goal of the work was to create standard offerings regarding marking of products and pallets that would meet the increasing number of customer demands at SWEP International. The possibilities introduced by the use of new technologies such as RFID was also to be investigated.

Introduction

This article is based on a master thesis work that was conducted as a case study together with SWEP International, an international manufacturer of brazed plate heat exchangers with headquarters in Landskrona.

SWEP has been receiving an increased number of customer requirements regarding part identification and marking of their products and pallets. The requests includes both the contents of the markings as well as how to represent data in an automatically readable way. This has created a need to find a standard approach of marking items while still remaining customer oriented. Recent years have provided new technologies such as RFID that needs to be investigated to understand what extra value can be provided.

Problem description and purpose

The thesis is based on two separate but interrelated problems. The first problem concern marking at both product and transportation level and originates from diverging customer demands regarding information in both plaintext and machine readable formats. The marking at product level is further complicated by the fact that the physical size of the product level marking cannot be increased while the plaintext and visual elements of the marking may not be smaller than they presently are. SWEP is also interested in evaluating future trends in areas where customer requirements are currently being met, in order to be proactive regarding new customer demands.

A goal for the work is to create a (set of) standard offering(s) for product and pallet marking to SWEP’s customers, thus avoiding the need for customer specific markings.

The second problem is related to minimizing errors in the internal production process. These problems stem from use of wrong materials or components or from wrongful assembly of components that comprise a product. This has occurred because material and components are used, that are not easily distinguishable by the human eye. And so SWEP needs a review of
methods that either makes such distinctions easier or in other ways ensures the use of the right materials or components.

In order to accomplish these tasks four main questions have been identified:

- What are real customer needs for product and transportation unit marking, and what marking options would be regarded as added value?
- How can SWEP improve material tracing with the use of modern identification technologies?
- What do SWEP’s suppliers offer in terms of marking of incoming goods?
- Are there standards for marking available that could help SWEP improve its marking offerings and cover the majority of customer requests?

When it comes to standard transportation marking we have chosen to focus our investigation efforts on the Odette standard and the AIAG standard. The focus regarding internal processes has been the production site in Landskrona.

**Method**

The work was conducted as a case study and primarily qualitative methods for gathering and analysing data has been used. A series of interviews with representatives from SWEP was conducted in order to create an understanding of the problems as well as to understand the business and production processes at the company. These interviews also provided information about customer requests.

After these interviews a survey with the sales department was conducted with the aim to reveal additional customer requests regarding marking and traceability.

We have also conducted surveys with suppliers of material as well as of transportation services. Price estimates regarding RFID equipment has also been gathered. With the goal to get a second opinion and widening our perspective an interview with a supply chain consultant was carried out. To gain knowledge about the Odette system an interview with the manager at Odette Sweden was also conducted.

Prior to, and in parallel with the interviews and surveys, existing literature and documents has been investigated in order to create a connection between the theory and the material gathered.

**Technologies and standards**

The mapping of the width and order of bars and spaces in a barcode is called symbology. The two most commonly used symbologies in industry are Code 39 and Code 128. Code 128 is a newer symbology, and has the benefit of being denser than Code 39. The majority of SWEP’s customers still use Code 39 but the number of customers that request barcodes to be in Code 128 is increasing.

Instead of using only one dimension, a barcode can be printed in two dimensions. This type of barcode is generally denser than linear barcodes, and commonly implements some type of error detection or checksum. The most common symbology in Europe is called Data Matrix; in North America PDF417 is the most common. The customer demands that SWEP has received regarding two dimensional barcodes has been based on the Data Matrix symbology.
Using Data Matrix up to 30% of the barcode can be damaged without loss of data however if the barcode is too damaged no data at all will be recovered. In other words using this symbology either all or no data is read. Unlike most other linear symbologies, and some of the two dimensional ones a Data Matrix is not orientation sensitive, which means that the marking could be read for instance upside down.

Barcodes can be printed on a label, or directly on a product using for example ink jet. Some symbologies, for instance Data Matrix, can be engraved directly into the cover plate of a product; this is called direct part marking.

To avoid reading the wrong barcode, prefixes can be used to let the system warn the user when a mistake is being made. The two most common standards for prefixes are Data Identifiers (DIs) defined by ANSI and mostly used in industrial contexts, and Applications Identifiers (AIs) defined by GS1, commonly used by retail. Customer demands received by SWEP conform to the ANSI standard.

Radio Frequency Identification (RFID) is a technology where radio waves are used for transferring information from a transponder to a reader. A transponder, often referred to as a tag, can hold a significant amount of data and the reading process can be made fast with a minimum of human work involved and without the need of free line of sight. Tags can be made of read/write format so that it is possible to change the information on the tag when requested.

EDI standards define structure of messages transferred in a machine readable fashion, nowadays commonly over TCP/IP. EDI messages regard commonly (re)occurring activities such as billing or advance shipping notification, and are intended for automatic handling without human intervention. There are many standards for EDI, and which is most used depends on region.

AIAG is an industry organization for companies associated with car manufacture in North America. AIAG has developed guidelines for development of transportation labels, these guidelines are relatively flexible compared to for instance transportation labels developed by Odette.

Conclusions
This work has resulted in several suggestions that are briefly explained below.

We suggest that SWEP takes advantage of the B10 standard to produce a transportation label similar to the example seen in Figure 1. This means that DIs are used as prefixes and linear barcodes of symbology Code 39 or Code 128 are used together with a Data Matrix. This label could be used in combination with the present transportation label to ensure that presently satisfied customers stay satisfied.

Since there exist customer requirements regarding both the Code 39 and the Code 128 symbologies we believe that SWEP needs to offer two versions of the B10 label, one relying on each symbology. In order to meet varying information requirements at least one barcode field should be possible for customers to specify.

We have not found a standard label that could replace the current product level marking. Due to the restraints in size and visual contents we suggest that SWEP adds a Data Matrix to the label. This will give SWEP the possibility to
encode more information on the label and to let the linear barcode be used for information specified by the customer.

We recommend that SWEP does not implement RFID at present. We have not found that RFID would increase efficiency in the production sufficiently to compensate for the costs introduced. The fact that we have not found any customer requirements regarding RFID marking at product or pallet level serves to substantiate this recommendation. SWEP should however pay attention to future changes in this area.

References

Figure 1 Example of pallet label relying on B10 standard