Annals of DAAAM for 2012 & Proceedings of the 23rd International DAAAM Symposium, Volume 23, No.1, ISSN 2304-1382
ISBN 978-3-901509-91-9, CDROM version, Ed. B. Katalinic, Published by DAAAM International, Vienna, Austria, EU, 2012
Make Harmony between Technology and Nature, and Your Mind will Fly Free as a Bird
Annals & Proceedings of DAAAM International 2012

CONTRIBUTION TO THE RELIABILITY AND SECURITY OF IDENTIFICATION OF HOT COILS IN THE PRODUCTION PROCESS

KISS, I[mrich]; WESSELY, E[mil]; MASLAN, M[ichal] & HRABCAK, M[ikulas]

Abstract: *Secure localization of products in the distribution network largely depends on the possibility of identifying the current location and activities of the technological process. The problem with the fulfilment of these assumptions may be non-favourable physical condition of the product in a determined location of marking connected with identifiers. The current problem in metallurgical production is a longer lasting problem in connection with the identification of hot coils. The contribution responds to that problem by identification and analysis of risks that may occur when applying modern identification systems.*
Key words: *identification, hot and cold coils, radio frequency system*

1. INTRODUCTION

Production of semi-finished products of metallurgical production is known by the fact that most of the manufacturing process is carried out in determined temperature regimes. Rolled semi-finished products in the form of hot coils leave coilers with an average temperature of 500°C. At the same time this place is seen as an important node in the production chain, whose configuration and timing performance are set out by the current sales plan and production.

This temperature zone and the applied method of marking technology may be considered a source of reliable – safe identification of rolled products in the distribution – stock networks.

Demands on the system of marking, which this variable use from the matrix input will be able to meet reliably, must bear multi-criteria risks of distribution network requirements, in which established logistics process of handling and transportation will be realized.

Applications of modern systems of coding and identifying products, even in extreme operating conditions, allow creating new concepts of material flow logistics management, including handling equipment.

Concepts in this issue reflect the development of bar code and tag recognition of products (transponders) by radio frequency identification.

The draft of hot coil bar code marking results from the possibility of applying two-dimensional bar codes on metal surface by means of laser firing or a microdot system.

The draft of marking by tags of radio frequency system is forced by new functional properties that allow coding of materials at a high temperature up to 500°C by means of a special coded chip encapsulation.

Remarkable are also the parameters of the memory capacity and a way of storing data on the progress of production technology of products from the production of hot coils. This positive assessment is currently unfavourably influenced by a relatively high price of elements (in particular, tags, radio frequency gateways, software, etc.) of the considered RFID system.

Solutions of technical issues are formulated as problems of laser applications or microdot head and tags in the temperature zone near 500°C.

2. THE CONCEPTS OF TRACKING AND TRACING (IDENTIFIABILITY AND TRACEABILITY)

Identifiability can be understood as a product feature that allows the immediate and unambiguous recognition of the technological process. It allows connection of information with identifiable parameters of the material flow.

Traceability is the ability to re-identify by identifying when, where, what, whom and how the product was made. The main objectives of identifiability and traceability are the following:

a) Expression of rolls/coils reference to finished product throughout the production cycle, including information about from where the roll came, with what quality parameters they were supplied to the process and who has worked on the production batch and where. For this purpose it is necessary to ensure that identifiers remain constant from the time of receipt of the coil to the delivery of the final product to the customer. b) Clear and unambiguous statement of the results of inspection and testing. Identification of the condition of the product, as well as the state after the inspection and testing must ensure that the customer got only product which has passed inspection and meets the requirements. c) When creating the concepts of identifiability and traceability, the nature of the processes, the complexity and size of the product should be taken into account.

An important factor influencing the effectiveness of identifiability and traceability system is a suitable choice of how to identify the product. Methods of identification should reflect the importance of the impact on product quality. The basic identifiers (codes) are: slab and coil number, coiler and shift number, date and time of manufacture, weight and quality grade, further processing, packaging and shipping, and customer and delivery point.

Currently used conventional methods of marking such as colour markers (chalk, paint), labels, stickers, tags, personal stamps with the name or number of the worker, etc.

The diagram (Fig.1) only shows flows links from the point (P 1 – coil winding machine) where each coil made indicates the basic code that identifies the coil throughout all of the process up to the point of the final customer. The following are the characteristics of other nodes:

P2 – work-in-progress stock are coils positioned according to specified addresses that correlate with successive technological operations. They are: cooling (48-72 hours), expedition (P5) and the distribution of hot coils to customers (approx. 55%), or the node P3.
P3 – rolling of cold coils (approx. 45%), including surface treatment and cutting strips or sheets.
P4 – storage of finished products – the allocation of products to specified location and localization of removed from stock products.
P5 – determined packaging carried out by expedition, loading on a ready means of transport.
P6 – distribution implements the physical transportation to customers.

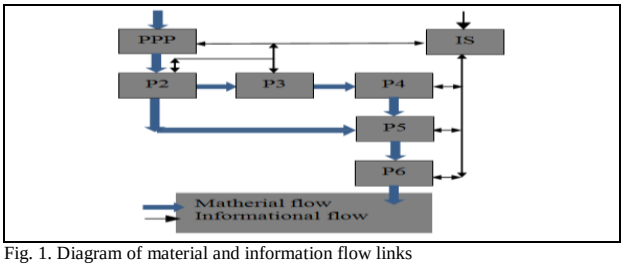

Fig. 1. Diagram of material and information flow links

Information system (IS) provides updated information for the production flow control process, which builds on the sales plan (includes all contracted certified products from the current batch – slabs), production scheduling, management of production logistics, organization of storage (sorting into zones according to the production flow plan, the blocks and lines storing), shipping and distribution including management (navigation) of handling and transport equipment. Handling coils, strips and bundles (metal sheet handling batch) is carried out by overhead cranes and gripper forklifts.

The proposed navigation will use handling equipment control within the specified area from point to point by radio-frequency system. In the allocated sites of three-dimensional coordinate system fixed radio frequency tags will induce the handling techniques to the determined location (line, column, floor) of coil, strip or bundle storage.

Sales plan is managed by the production planning system, which consists of the follow-up phases of income and cancelling orders, conclusion of supplier – customer contracts and reserving production batches. Control of manufacturing processes in real time is exploiting a virtual reality system, the basic assumption of which is the application of a reliable system of material flow parameters identification.Individual coils and products are coded by means of a system in which each character or sequence of characters is/are assigned a character or a sequence of characters from another character set.

General files of applicable codes:
- a set of hot coils, number, size and weight of the coil,
- a set of addresses of hot coils storage in storage areas and zones, and in the manner of storage in blocks or in lines, a set of codes of technological operations, dispatch codes, distribution codes, additional codes, for operational needs.

3. IDENTIFICATION OF RISKS

Experience has shown that the aim of identifying risks is to detect existing risk sources of risk location and localizations before there is any incident with possible seriousconsequences for the ongoing production process. The purpose of risk-analysis is expected to identify the anticipated causes of failure of a certain part of the process, or an element of the system. The table below includes an expert assessment of comparison of risks of the planned bar code applications and radio-frequency identification chips in the selected nodes of the analyzed production process.

No.	Risk	Bc	RFID	Comment
1.	Temperature of 500°C	+	+	Coding
2.	Location	+	+	Coil
3.	Location and localization1	+	+	Organization of storage
4.	Location and Localization2	-	+	Handling equipment
5.	Location and Localization3	-	+	Material flow
6.	Investment cost	-	+	
7.	Reliability	-	+	

Tab. 1. Benchmarking of applied codes risks

Characteristics of risks:
- The temperature of 500°C: extreme temperature zone, particularly the specific functional properties of coding systems.
- Location: the application of codes of coils.
- Location and localization 1: storage at the specified address in depot zones, blocks or lines, and removal from the specified address of zones, blocks and lines.
- Location and localization 2: automated navigation of overhead crane and a forklift to the determined addresses (locations) and from the determined addresses (allocations).
- Location and localization 3: tracking the flow of semi-finished goods and semi-finished products in production process according to determined technological procedures, including expedition and distribution processes.
- Investment cost: expert estimate of cost.
- Reliability: expert assessment of the risks of operational reliability.

4. CONCLUSION

The risk analysis described in metallurgical production processes and its application to specific technologies that are and always will be in economic pressure, can help ensure higher quality of output, as well as the application of legitimate claims to improve the work area and its ecology. After successful validation in the real operating conditions, the described method of identification and analysis of marking of products in hot processes can be a good step towards the total automation.

5. REFERENCES

[1] Henrici, D.: RFID Security and Privacy, Springer-Verlag, Berlin, 2010, ISBN 978-3-642-09792-8
[2] Nenadál, J., Noskievičová. D., Petřiková, R., Plura, J., Tošenovský, J.: Moderní systemy řízení jakosti, Managent Press, Praha, 2002, ISBN 80-7261-071-6
[3] Poirer, CH., McCollum, D.: RFID Strategic implementation and ROI, G. Roos Publishing, 2006, ISBN 1-932159-47-9
[4] Thomas, R.,: RFID succes cecrets – 100 most asked questions, Lightning Source UK Ltd. 2010, ISBN 978-0-9805-1360-8
[5] Thornton, F., Haines, B., Das, A., Bhargava, H., Cambell, A., Kleinschmidt, J.: RFID Security, Syngress Publishing, 2006, Rockland, ISBN 1-59749-047-4
[6] Rusko, M., Králiková, R.: Application of Six Sigma Method to EMS Design, 2011. In: Research papers, Yearly issue 19, no. (2001) pp 39-44. ISSN 1338-0532
[7] Kraliková, R., Mihalikova, R.: Product life cycle management application, Cairo 2009. Pp 207-208. ISBN 978-9958-624-29-2