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FMEA ANALYSIS OF XEIKON ELECTROPHOTOGRAPHICS

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Abstract: *By introducing FMEA analysis of Xeikon DCP32D electrophotographic printing model it is shown which components of the machine are weakest link in the printing. Each component is shown separately according to the modules and units of the machine, so that the critical component of each module can be read. Solution is in improving critical component and suggestion is to evaluate and validate this component using FMEA analysis.*
Key words: *Xeikon FMEA, Xeikon electrophotographic model, failures in digital printing, corona wire failure, scorotron failure*

1. INTRODUCTION

Today, construction and design of digital printing machines are known. To observe a specific digital printing technology and set forth corrective actions associated with potential faults in the model, it is necessary to analyze and evaluate each component of a digital printing machine. Evaluation of the failure is given critically: firstly we give the assessment of failure probability during the half-year work of the machine and afterwards we evaluate the consequences of error for that failure. For this kind of analysis, it is necessary to understand the construction and the design of the Xeikon digital printing machine, and to have the practical experience in operating the machine. FMEA (Failure Mode Effect Analysis) was taken as a widespread method of assessing the severity of specific modules and components of a digital printing machine (Stamatis, D. H., 2003).

1.1 Description of a model of digital electrophotographic printing process

Model of a digital printing process is taken from the Xeikon DCP32D (electrophotographic/xerographic model (Kipphan H. (Ed.), 2001)), and it is one of the most frequently used models in digital printing industry. This model is used in most digital printing machines, ranging from the photocopiers to home laser printers that have simplified and cheaper model. Our research is based on the most complex electrophotographic model, Xeikon DCP32D, whose functioning has been tracked and stored in the database during 12 years. All failures described and presented in this paper were analyzed by FMEA analysis.

1.2 Advantages and disadvantages of electrophotographic digital printing

Advantages and disadvantages are well known since the first implementation of electrophotographic models and we have extracted here advantages and disadvantages of basic model and of Xeikon DCP32 model.
The main advantages of electrophotographic printing model (Žiljak et al., 2007) are:

a) Ability to print one or more prints without making an offset plate, and to change them (variable press form)
b) The possibility of printing multipage books with a built-in postpress process.
c) Short start-up period for printing
d) Personalized printing (addresses, labels, personalized newspapers, etc.)
e) Quality reproduction for an acceptable price per print

The main disadvantages of electrophotogr. printing model are:

a) A slow speed of printing compared to offset press
b) Large life cycle cost of the machine, consisting of: a shorter working span, the costly parts and ecological disposal
c) Limited and expensive 'spot' colors
d) The problem with covering of uniform areas with 100% coverage when using the dry toner

The advantages of Xeikon electrophotographic digital printing model are:

a) Print from the roll (variable paper size on one axis depending on the RIP memory)
b) Simultaneous duplex color print
c) Possibility of fast individualized printing (depending on the RIP and PES configuration)

2. THE ROLE OF FMEA ANALYSIS IN IMPROVING THE PROCESS OF DIGITAL PRINT

To provide improvements of the Xeikon DCP32D digital printing machine we have taken data from its work database created during 12 years (Yang, K. & Basem El-H., 2003), and we have analyzed that data on the basis of half-year occurrence of certain problems. We used FMEA process is to: 1) assess the risk associated with potential errors, 2) rank the problems by relevance and 3) find most important problems of the product or the process. There are several types of FMEA analysis; we used Process FMEA analysis to describe, rank and find the failures that cause the greatest problems, and to assess the risks of all errors.

2.1 FMEA analysis of a complex system

To assess the risk associated with errors that happen on Xeikon DCP-32D, and to offer some solutions, we have introduced the division structure of the machine. We have divided the machine according to the basic structure:

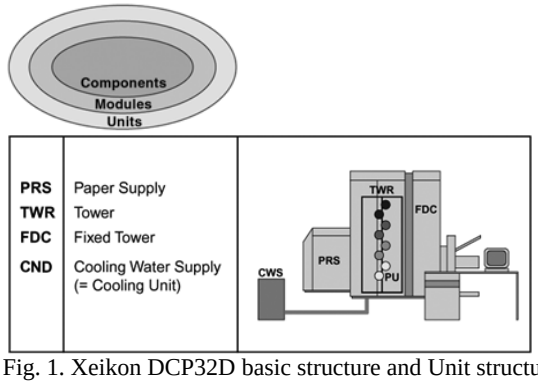

Fig. 1. Xeikon DCP32D basic structure and Unit structure

Fig. 2. Xeikon DCP32D

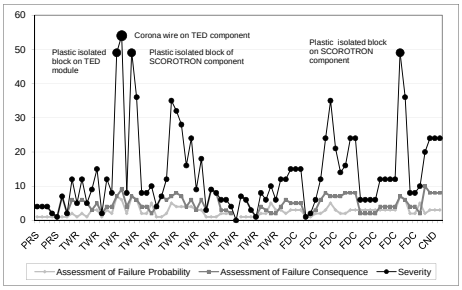

Chart 1. FMEA analysis of XeikonDCP32 electrophotographics

The basic structure is: Machine units, Machine modules and Machine components. Machine units are: PRS (Paper Supply), TWR(Tower), FDC(Fixed Tower) and CND-CWS(Cooling Unit) as shown Fig. 1. For individual machine units we have listed the machine modules and for each module we have extracted its components. When we put all this in Excel table, the FMEA analysis diagram is set. Then each component is critically assessed concerning the probability of failure in the ½ year span and the consequences of the failure for the system. By using a formula (1) we get the severity value. Formula (1) and Chart 1. is described as:

AFP = Assessment of Failure Probability
AFC = Assessment of Failure Consequence
SEV = Severity

Formula for FMEA analysis is:

$$AFP \times AFC = SEV \qquad (1)$$

3. RESULTS OF THE FMEA ANALYSIS

Critical component that came out of FMEA analysis is the TED unit component. It is a transfer corona, which is used to retain the applied toner on the opposite side of the print until the fusing. The problem is, when the corona breaks, it folds, falls down and touches the drum with the printing unit or touches the TED shield, bringing 650 V and thus creating a short circuit. The machine sanctions it and turns off the power supply of the TED driver board, but nevertheless the drum can be damaged. Also, the second failure is related to the TED unit module, which creates a similar problem (short circuit), but this time the plastic that holds the corona at the distance from the unit's shielding is the source of the problem. Since the corona is in a direct contact with the plastic, and the plastic is in contact with the shield, the plastic becomes fatigued, i.e. by the influence of toner dirt and the low quality plastic, the short circuit, alarm, and problems in the print occur. With this analysis we have defined the priorities and in that way we have found the critical points, we have gained an insight into the functioning of the machine, noticed which components we have to pay attention to during the work and which components need a possible change in design.

4. CONCLUSION

In this work we wanted to introduce FMEA analysis of Xeikon electrophotographic printing model for the first time and we wanted to find out which components of the machine are the weakest link in the printing (Fig.1., Fig. 2., Fig. 3. and Fig. 4.).

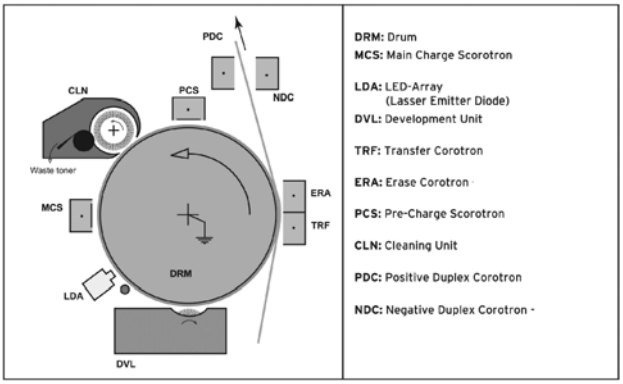

Fig. 3. Xeikon DCP32D – One Print Unit structure (there is 8 Units in Machine used for Duplex full colour printing (Xeikon NV, 1996))

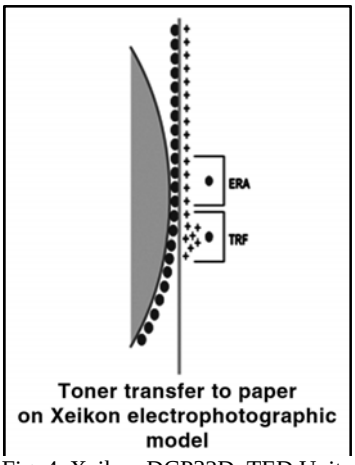

Fig. 4. Xeikon DCP32D TED Unit with critical component corona wire (used for electrostatic toner transfer on paper)

Each component is shown separately according to the modules and units of the machine, so that the critical component of each module/unit can be read (Chart 1). FMEA analysis has shown the critical component of the machine that causes the losses in production, delay and the additional costs. This component should certainly be improved and the further monitoring of the machine via FMEA analysis is suggested so the corrective actions can be validated (Yang G., 2007).

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