EMPLOYEE TRAINING FOR THE IMPLEMENTATION OF QUALITY STANDARDS IN OFFSET PRINTING

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Rezumat. *Pentru a putea imprima conform ISO 12647 sau a oricărui alt standard, avem nevoie de oameni pregătiți în a înțelege cerințele de bază ale implementării standardelor în tiparul offset. Calibrarea și controlul procesului de tipar merge mână în mână cu timpul, reducerea costurilor, reducerea deșeurilor și creșterea satisfacției clienților. Decizia de implementare a fost luată pentru a oferi o comunicare a calității culorilor ușoară și precisă. În această lucrare este prezentată abordarea instruirii personalului necalificat adoptată pentru analiza, certificarea și controlul culorilor asupra întregului flux de lucru al producției.*

Abstract. *To be able to print according to ISO 12647 or any other standard, we need trained people to understand the basic requirements of implementing the standards in the offset printing. Calibration and control of the printing process goes hand in hand with time, costs reducing, reducing waste and increasing customer satisfaction. The implementation decision was taken to provide a light and accurate color communication. This paper presents the training of unqualified personnel for the analysis, certification and color control over the whole production workflow.*

Keywords: Quality, professional training, standards, printing, color management

1. Introduction

Due to the constant increase of the quality requirements, prices and production volumes, an ISO standard implementation require stricter discipline to correctly implement and maintain workflows if they are to deliver consistent results to higher expectations. This requires: an integrated industrial manufacturing strategy that combines standardization, process control and defined procedures. Also, all of the production equipment's used must be operating to specification, effective maintenance and also the understanding of the influence of consumables (ink, paper, blanket, etc.) [1], [2], [3]. Achieving consistent and very similar printing results on print jobs produced by the same printer, is challenging and requires a very high level of process control and discipline.

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- As defined by the law, the professional training has the following objectives:
- The adapting of the employee to job requests;
- Obtaining a professional qualification;
- Updating the knowledge and the skills specific to the job and perfecting the professional training for basic occupation;
- Professional reconversion result of socio-economic reorganization;
- Acquiring advanced knowledge of modern methods and procedures, necessary to carry out professional activities;
- Preventing the risk of unemployment;
- Promotion at work and career development.

The purpose of this paper is to raise awareness of requirements and enforcement needed for the implementation of a printing process control in terms of human resources.

2. From density to colorimetry

ISO 12647-2:2013 specifies a number of process parameters and their values to be applied when preparing color separations for four-color offset printing or when producing four-color prints by one of the following methods: heat-set web, sheet-fed or continuous forms process printing, or proofing for one of these processes; or offset proofing for half-tone gravure [4], [5], [6].

The printing process we used is heat-set, and is called heat-set printing technique because of the way the ink is drying and not due to the nature of printing technology. (Figure 1)

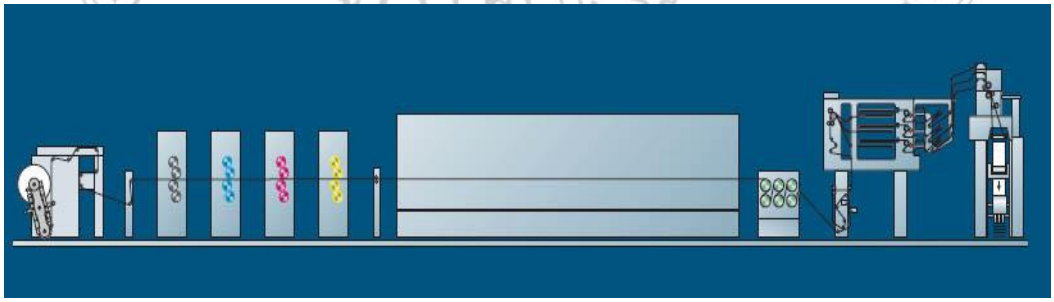

Fig. 1. Heatset printing machine.

The main method of verifying and keeping the colors under control on the printing machines, is the use of automated controls. Those devices read the density from a special color bar printed during production. (Figure 2)

Colour	Name	C	M	Y	K
	100% C	100	0	0	0
	75% C	75	0	0	0
	50% C	50	0	0	0
	25% C	25	0	0	0
	100% M	0	100	0	0
	75% M	0	75	0	0
	50% M	0	50	0	0
	25% M	0	25	0	0
	100% Y	0	0	100	0
	75% Y	0	0	75	0
	50% Y	0	0	50	0
	25% Y	0	0	25	0
	C+M	100	100	0	0
	M+Y	0	100	100	0
	C+Y	100	0	100	0
	Paper	0	0	0	0
	25% K	0	0	0	25
	50% K	0	0	0	50
	75% K	0	0	0	75
	100% K	0	0	0	100

Fig. 2. Automated control color strips.

In the past, the main method for the printers to assess the color quality was based solely on the density targets set on the automatic density control devices. Nowadays, the color quality requirements extend beyond the basic knowledge of the printers. We had to make them shift their attention from density to colorimetry.

Color standards have been in use in the printing industry for a long time. And various different measuring devices are used to monitor compliance with these standards. The automatic devices allow the printer to assess and adjust the ink zone opening. This process is extremely time-intensive because several ink zones have to be adjusted at the same time. This is a relatively reliable process when performed by experienced operators printing process colors and the corresponding density values. The filter colors of the measuring devices are generally only designed for the process colors cyan, magenta and yellow and the density values

displayed do not enable reliable control recommendations to be obtained. And it's practically impossible with colorimetric values, since three-dimensional Lab values are difficult to correlate with the thickness of the ink layer. For printers looking not only to measure and control the printing process in terms of density and tonal values but who also set great store by visual agreement between the print and the original (proof, previous print run) or who have to achieve ISO Lab data, we have to use the colorimetric approach (Figure 3).

Colour	Paper type [a]											
	1, 2			3			4			5		
	L^* [b c]	a^* [b c]	b^* [b c]	L^* [b c]	a^* [b c]	b^* [b c]	L^* [b,c]	a^* [b c]	b^* [b c]	L^* [b c]	a^* [b c]	b^* [b c]
Black	16	0	0	20	0	0	31	1	1	31	1	2
	(16)	(0)	(0)	(20)	(0)	(0)	(31)	(1)	(1)	(31)	(1)	(3)
Cyan	54	–36	–49	55	–36	–44	58	–25	–43	59	–27	–36
	(55)	(–37)	(–50)	(58)	(–38)	(–44)	(60)	(–26)	(–44)	(60)	(–28)	(–36)
Magenta	46	72	–5	46	70	–3	54	58	–2	52	57	2
	(48)	(74)	(–3)	(49)	(75)	(0)	(56)	(61)	(–1)	(54)	(60)	(4)
Yellow	87	–6	90	84	–5	88	86	–4	75	86	–3	77
	(89)	(–5)	(93)	(89)	(–4)	(94)	(89)	(–4)	(78)	(89)	(–3)	(81)
Red, M+Y	46	67	47	45	62	39	52	53	25	51	55	34
	(47)	(68)	(48)	(47)	(67)	(43)	(54)	(55)	(26)	(53)	(58)	(37)
Green, C+Y	49	–66	24	47	–60	25	53	–42	13	49	–44	16
	(50)	(–68)	(25)	(50)	(–64)	(27)	(54)	(–44)	(14)	(50)	(–46)	(17)
Blue, C+M	24	16	–45	24	18	–41	37	8	–30	33	12	–29
	(24)	(17)	(–46)	(25)	(20)	(–44)	(38)	(8)	(–31)	(34)	(12)	(–29)
C+M+Y [d]	22	0	0	22	0	0	32	0	0	31	0	0
	(23)	(0)	(0)	(23)	(0)	(0)	(33)	(0)	(0)	(32)	(0)	(0)

Values in parentheses pertain to measurements with a specified white backing specified by CGATS.5 [5] and are given for information only.

[a] Paper types as specified in 4.3.2.1.

[b] The colours were derived from those given in ISO 2846-1[1] by the method described in Annex A.

[c] Measurement according to ISO 12647-1: D50 illuminant, 2° observer, 0/45 or 45/0 geometry, black backing. Values in brackets pertain to measurement on the white backing specified by CGATS.5[5].

[d] Given for information only; overprint values entered for the purpose of profile building calculations. Practical values scatter in region defined by $C^* < 5$.

Fig. 3. LAB data values for different types of paper according to ISO 12647.

In practice, this means that the printer can see at a glance whether he can achieve the desired color result or not. If all parameters in the printing process are optimally coordinated, it can be assumed that the desired result will be achieved. So, if the printer were to rely solely on specified densities, the optical impression

could end up being different. The job description for a press operator in its most basic form can be broken down into these primary functions:

He has to prepare the press for printing. This may involve many "presets" that the specific job requires. Paper must be loaded and plates must be mounted on the press. Many other presets relating to ink settings or paper width are also under his supervision. Also, he operates the press. While the press is running, he makes all decisions as to what is acceptable and unacceptable. He makes assignments on his crew if he has others working with him and monitors their progress. The press operator also takes the lead in solving problems and working with any crew member in finding a solution. He also keeps the printing press supplied with any materials in order to keep running such as ink, paper or fountain solution.

The ability to troubleshoot is a foremost quality of a press operator. As one who takes full responsibility for the printed product, this one must have a sufficient enough understanding of every component of the offset printing press that he can discern where a problem may be originating. A press operator must be able to troubleshoot them. Offset printing does not produce perfect products. Every good press operator knows that there is constantly something to improve in the process. However, a good press operator knows where to draw the line when it comes to acceptable or unacceptable quality and can do so on a press check.

In terms of color quality management, unfortunately, the vast majority of the Romanian printers are just machine operators, trained on the working site, on different types of printing machines, without any knowledge of colorimetric requirements.

3. Talking the same language

In order to improve the knowledge of the press operators, we created a set of operational procedures, training courses and hands on approach.

The operational procedures were created whit step-by-step instructions that will lead to efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with the standards. (Figure 4)

The training courses were designed to prepare the printers for the new challenges that arise from the new types of measurements that they will have to make. They were presented with the new measuring devices, new ways on how to print by the numbers (Lab targets, dot gain values, composed grey values) and the new approach on the quality of the printed products based on the different types of software that will be used during production runs. (Figure 5)

Fig. 4. Start-up procedure displayed at the printing machine.

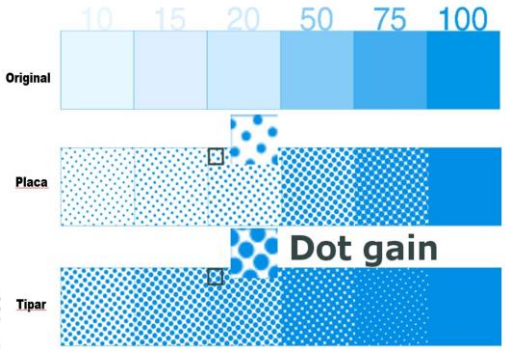

Fig. 5. Dot gain (TVI) in different stages of production.

The hands-on approach was the most intensive part of the training, consisting in production print runs measured with the new devices, making the necessary setups and corrections according to the new methods and assessing the printing product not only by visual judging, but also by the measured results of the samples selected during different stages of production (start-up, before plate change, after the reel change, after automatic wash up or at the production end) [7], [8], [9].

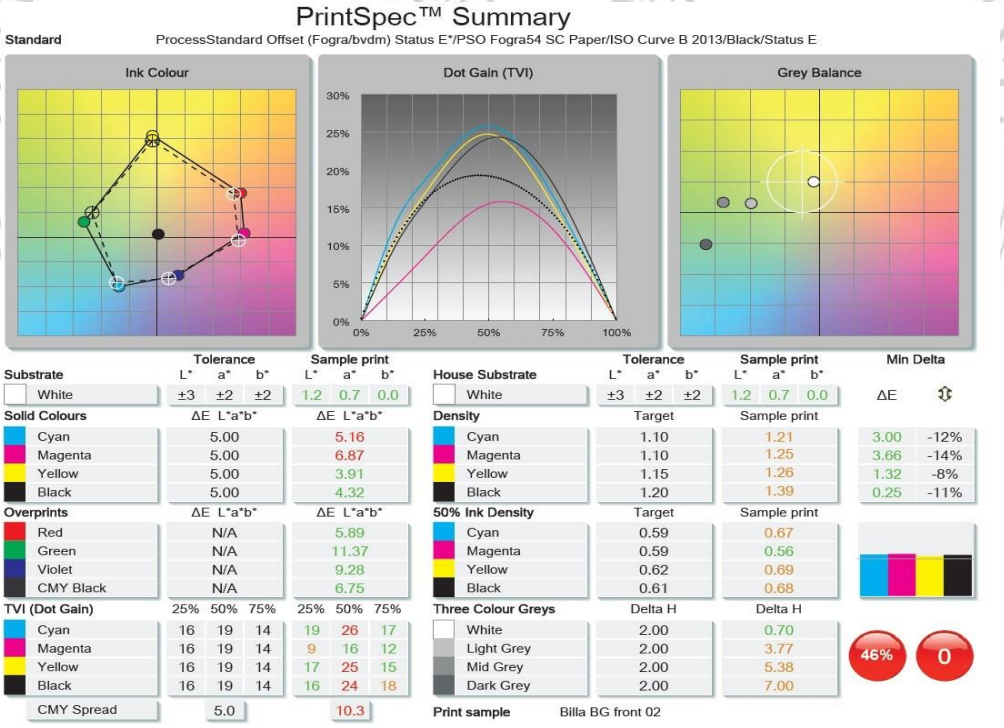

Fig. 6. Result of the measured sample visually describing the values.

The software used for measuring the printed results is not only showing the measured values of the color strip, but also has a visual approach for the changes that have to be made on the printing machine. (Figure 6)

4. Implementation results

During the implementation period, the main complaints of the people involved in the project were:

- Very difficult to achieve the desired results
- Higher ink consumption on the same job types
- Mismatch between the proof and the printed product
- Not understanding the relationship between water and ink balance

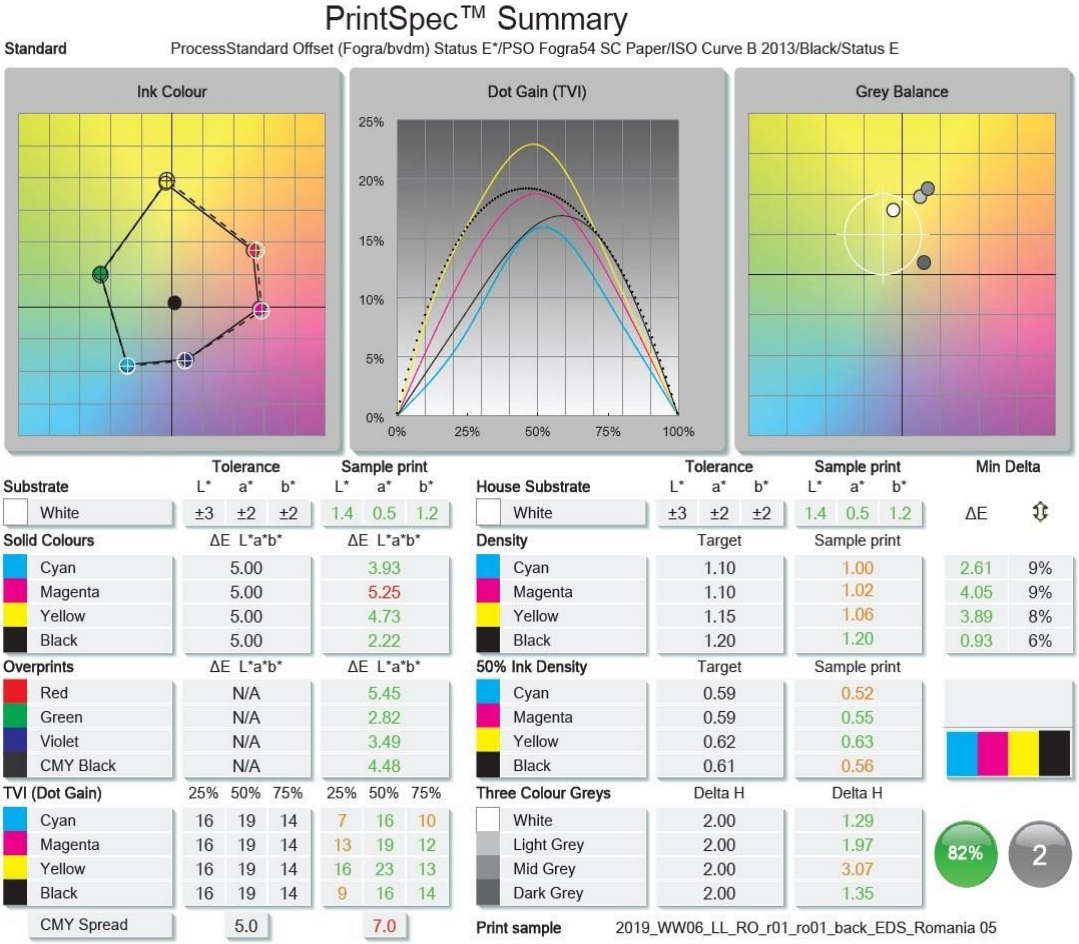

Fig. 7 Measured values after the training period.

After several weeks of measurements done by the printers without the help of the trainers, the complaints started to fade. The quality of the printed products started to increase, the ink consumption started to stabilize, and the proofs matched the print (Figure 7), according with the references [10], [11].

The main advantages of the new way of assessing the quality of the printed products are:

- Better results of the measured products, with a lower number of complaints from the client side based on the quality of the final printed product
- Shorter make ready times between the printed jobs
- Better repeatability for the same type of job
- A more accurate way of communicating the problems that appear on the printing machine
- Higher usability of the printing machine by understanding the process not just operating a printing machine
- A higher coherence between the members of the printing team

5. Conclusions

After six months of printing "by the numbers", we discovered that using a trained workforce improved production, reduced production costs, and mistakes, and also created a better working environment. We observed that the training made workers better and more capable of their jobs, it reduced the time it takes to start the job, and also the time to achieve the right color targets. This also helps to quell redundancy of effort where multiple employees are attempting to perform the same task, not realizing whose job it really is. The time and money it takes to correct mistakes are also lessened greatly when employees have the tools to do the task right the first time.

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Notations and/or **Abbreviations**

TVI – tone value increase

Lab – It expresses color as three values: L* for the lightness from black (0) to white (100), a* from green (-) to red (+), and b* from blue (-) to yellow (+).

R E F E R E N C E S

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