

THE STANDARDIZATION OF OFFSET AND FLEXOGRAPHIC PRINTING PROCESS ACCORDING TO ISO STANDARDS

Professional paper

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Abstract

The concept of the PSO as an upgrade in the process of standardization of the offset printing house is explained. The procedure for harmonization of the printing process in the printing house with relevant ISO standards is proposed. The potential problems which could complicate the standardization due to the complexity of the flexo and offset printing processes are analyzed. An overview of the novelties brought by ISO 12647-2:2013 comparing to the version from year 2004 is presented. The effects in printing production that can be achieved by standardization of printing process are presented. The results of the research of implementations of standards in printing companies in Bosnia and Herzegovina are analyzed.

Keywords: PSO standardization, offset printing, flexographic printing

Introduction

The standardization process of reproduction in the printing industry is a very important process that requires some effort and investment, but, properly understood and applied, standardization can bring significant improvements in technological, technical, organizational and financial terms.

The term standardization in the common sense includes two processes:

- the development of standards and
- their application.

Other aspects of standardization will be considered in this paper such as – application and introduction of standards in the printing companies of offset and flexographic printing, but before that it is necessary to mention the most important international standards brought by the ISO Technical Committee TC 130 for graphic technology.

Among these standards is the most important series of standards ISO 12647:

Graphic technology – Process Control in the making of separation of more tones, test proofs and proofs from circulation. This series includes seven standards which prescribe conditions of color separation, Proofing and print circulation for all classic procedures of printing and digital print (Part 1 – general Remarks; Part 2 – offset; Part 3 – Newspaper offset, Part 4 -

Process Standard Gravure Part 5- flexographic printing, Part 6 - screen printing, Part 7 - Digital Proofing, Part 8 – validation of printing processes which work directly with digital data).

In addition to ISO 12647 series of standards, for Standardization of the printing process more or less are important the following standards from the scope of the Technical Committee ISO TC 130:

- ISO 12643: Graphic technology – Safety requirements for graphic technology equipment and systems (series of five standards);
- ISO 12637: Graphic technology – Terminology (dictionary);
- ISO 15930: Graphic technology – Application of PDF formats, files for digital data exchange in preparation for printing (series of seven parts);
- ISO 5776: Graphic technology – Symbols for text corrections;
- ISO 12646: Graphic technology – Screens to display any color which will be in the proofs (soft-proofing) – Characteristics and conditions of observation;
- ISO 11084-2: Graphic technology – Register of systems for photographic materials, foils and paper, Part 2: Register of systems for making plates;
- ISO 12218: Graphic technology – Process control-Development of offset plates;

- ISO 13656: Graphic technology – Application of reflection densitometry and colorimetry of process control or estimate prints and proofs;
- ISO 3664: Graphic technology and photography – Terms of observation.

Considering that ISO 12647 standard is not sufficient to complete the standardization process of graphic reproduction, from the receipt of the files to the finished prints, but also that there are a number of ISO standards, not all of which are equally important for Standardization of the process of reproduction. Relevant institutions, including the most influential FOGRA developed concept called PSO, PS or PSG (PSX), depending on which the printing process applies:

- Process Standard Offset – PSO;
- Process Standard Gravure – PSG;
- Process Standard Newsprint – PSN;

The aim of introduction of the PSX procedure is to ensure that the printing companies in the right way, on the basis of recommendations and instructions of accredited institution for certification, fully harmonize

the overall process of graphic reproduction with ISO standards and good manufacturing practices.

According to PSU procedure, the number of ISO standards which must be taken into consideration is reduced to the following five graphics, and a general standard, which is not mandatory, although its introduction eases the introduction of graphic standards [1]:

- ISO 9000, for the organization and documentation (is not a condition, but it is recommended that there is at least partial compliance).
- ISO 15930;
- ISO 12646;
- ISO 12647-2;
- ISO 3664;
- ISO 12647-7.

It may be noted that modern production of printing forms using the CTP device is not covered by modern standards, but if such standard is enacted, it will certainly be included in the PSO procedure.

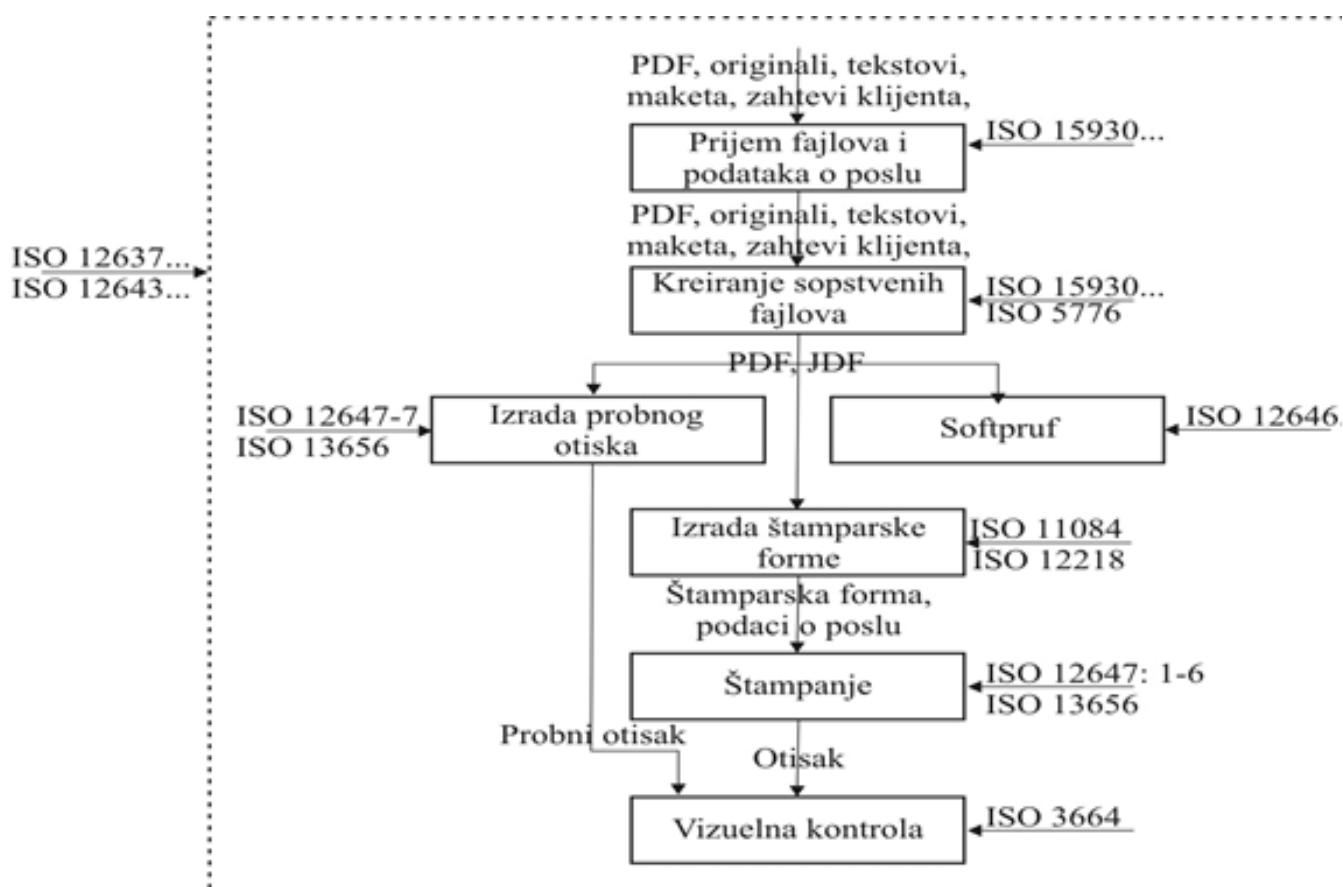


Figure 1. Schematic representation of workflow of graphic reproduction according to the concept PSO, with presentation of relevant ISO standards

Figure 1 schematically shows the process of playing with systematization adopted for PSO certification, as well as connection with certain ISO standards for graphic technology.

It can be noticed that the concept of ISO certification of graphics reproduction is broken down into seven steps:

- Receipt and control of PDF files from clients;
- Development of own PDF files;
- Preparation of the proof;
- Preview of the colors on the monitor which will be obtained in the press;
- Printing form Production
- Printing;
- Visual control of the print.

Each of these phases is separately evaluated during the certification of the whole process of reproduction, and to obtain a certificate for each there must be received a satisfactory score and achieved a satisfactory

overall score. Certification may be partial, whereby in the certificate that part of the reproduction process that complies with the ISO standard is emphasized. For example, the printer can receive a certificate which states that its printing proof complies with the ISO standard.

With the PSO certification of printing and studies for the preparation for printing in Europe, deal several companies, including the most famous German FOGRA [2] and the Swiss UGRA [1]. Besides these also operating are the Dutch IGT Testing Systems [3] and the less known German Print Quality [4]. There are a number of partner companies that operate under the auspices of FOGRA or UGRA.

Regardless of the potential benefits of the harmonization process of reproduction with ISO standards, the process of introducing standards in this area is not very far, at least not formally. Table 1 presents the number of printing companies that have FOGRA PSO certification by country (about 1/3 of the total number has only partially certified reproductive process).

Table 1. Number of PSO certificated printing companies by countries [5]

Country	Number of PSO certificated printing companies *	Country	Number of FOGRA PSO certificated printing companies
Austria	10	Germany	187
Belgium	1	Poland	1
Czech Republic	1	Portugal	1
Estonia	1	Romania	1
France	2	Singapore	7
Croatia	3	Slovakia	1
Netherlands	6	Slovenia	1
Italy	5	Serbia	3
Japan	16	Spain	7
SAR	1	Turkey	17
China	4	UAE	3
Luxemburg	1	UK	1
Malaysia	6	Total	287

Given the enormous number of printing companies (for example, in the UK there are about 8600 companies engaged in the press [6], and only one has the PSO certification), it can be concluded that the number of PSO certified printing companies is still insignificant. However, one can, with certainty, assume that the number of printing companies in which they realized that it pays off to harmonize reproduction process with the appropriate ISO standard, even without a certificate, is significantly higher, but for various reasons, the certification process has not been finalized. In the coming paragraphs the procedure of certification will be explained and the effects will be analyzed

2. Preparation of the printing company for PSO certification

In order for a printing company to receive ISO certification, it is necessary to pass certain steps, which

based on past experiences are rather well defined. One of the possible ways from a non-standardized to a certified printing company is shown in Figure 2. In order to obtain the certificate, it is necessary to do all the steps, but every journey begins with the first step - in this case it is the decision of the controller of the company to fix its production. In the decision, there are several motives, which sometimes act in synergy:

Participation in tenders. This is in our area one of the most important reasons that managers are at all interested in the ISO 12647, or PSO certification. As the number of tenders is increasing for large (government) jobs in which as a qualification condition ISO 12647 is listed, and well-organized private companies increasingly seek evidence from suppliers on standardization of production, it is expected that the number of PSO certified printing companies will begin to significantly increase.

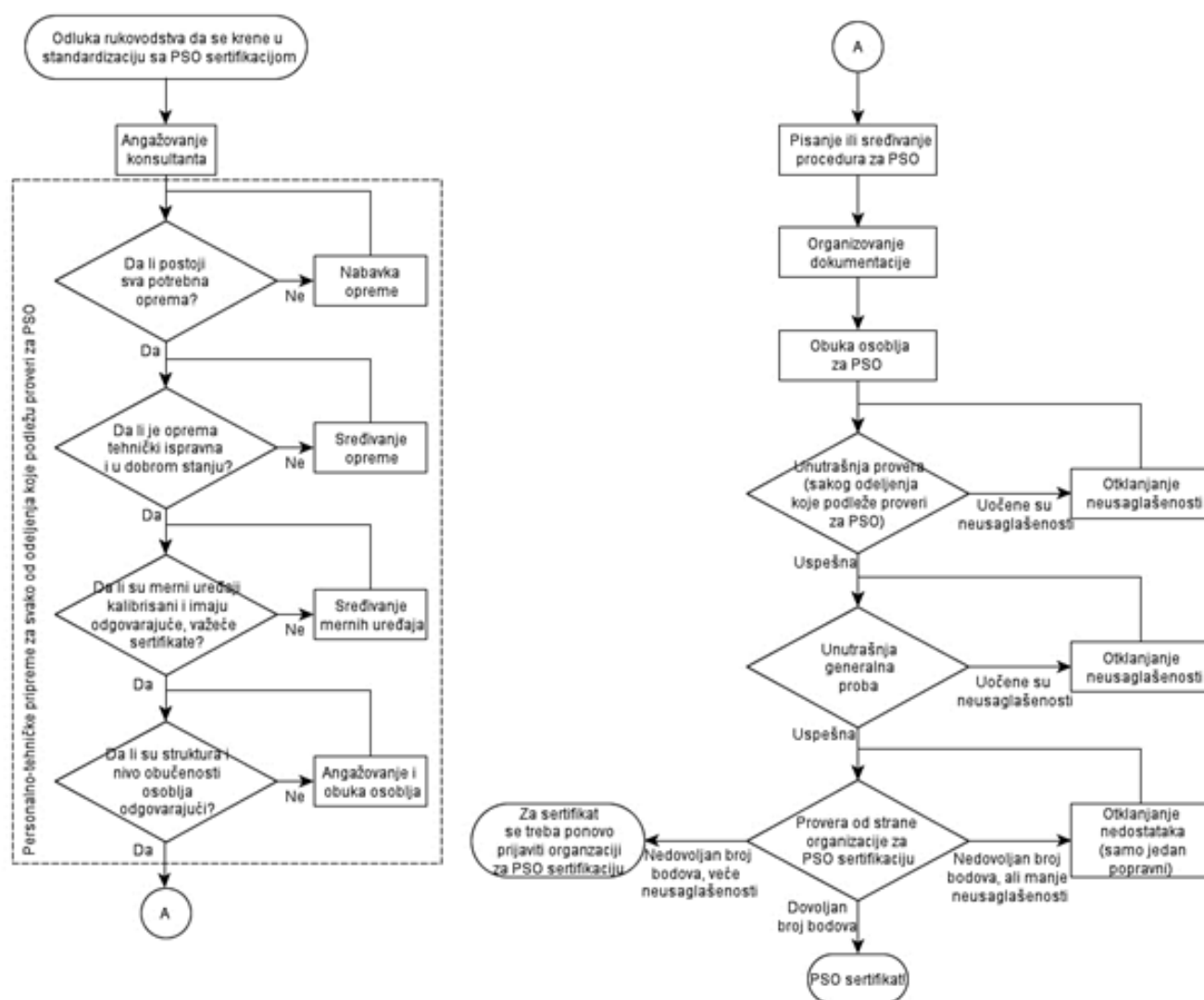


Figure 2. Schematic representation of the procedure for obtaining ISO certification in the printing that was not standardized

- The savings, increased efficiency. Some managers of companies have realized that it is not important how much something that should be invested in improving of the production costs, but how much money it can bring.
- Prestige. There are managers who want their company to be one step ahead in every possible way, and at the top in its market, so obtaining a certificate is sometimes a way to emphasize the excellence.

All three reasons to make the decision on the certification basically still have the most important one in common: to obtain higher quality jobs and achieve higher profits.

Practice has shown that printing companies should hire a consultant, certified by the PSO certification body, which will:

- Objectively evaluate the initial state.
- Develop a plan of preparation for the certification.
- Control the implementation of the plan.
- Assist in the improvement of procedures.
- Assist in writing and organizing of the documentation.
- Conduct training related to PSO certification.
- Do internal checks by departments.
- Do a rehearsal of the certification.
- Be responsible for the full certification process.

Although the scoring system throughout checks for obtaining the certificate does not require to reach 100% of the possible number of points, meaning that it is not necessary to have everything from equipment, it is necessary to have a lot of things: measuring devices, software, hardware etc. People must be well trained for their jobs. It usually requires initial investments in order to meet a set of conditions that are required before the general approach to the preparation for the certification, and harmonization process of reproduction with ISO standards.

If in the printing company already exist a good practice, existing procedures should not be changed. It does not exist a standard prescribed form to the procedures that is written or shown. During checks it needs to be controlled:

- Do procedures exist.
- Are they correctly written down.
- Do employees know where they can find them.
- Are the employees familiar with their contents.

However, if the initial state in the printing company is unregulated and there are not any procedures, then throughout the preparation for the certification they must:

- Check that the tasks are done in the best possible way.
- Improve the existing mode.
- Write a document describing the procedures.
- Ensure that employees are familiar with the new procedures and that the procedure is respected.

The organization of documentation for PSO is largely facilitated if the company already has a certificate ISO 9000. If not, then it is necessary to prescribe:

- A document form with the procedures and work instructions.
- A way of saving documents (paper and / or digital form, location).
- Availability of documents to individual employees.
- The system of work on the creation of new and revision of existing documents.

Staff training for the PSO certification consists in getting acquainted with the approved procedures, and to get used to working strictly by them. It is understood that employees have a solid basic education in graphics and they have the expertise for the specialty they deal with in their workplace.

During preparations for the certification, by achieving a certain level of preparation and training there are internal checks organized often with the assistance or under the supervision of an engaged consultant, by individual departments and workplaces. These internal checks are there to show, first of all employees, how much they adopted a new way of working. The number of these internal checks is not defined, it should be done as many times until achieving the results that guarantee to obtain a positive assessment during the official PSO checks.

When a satisfactory level of preparation in all departments is achieved, it is necessary to perform a general rehearsal of certification in all departments, which should be very strict. Only after a successfully crafted general rehearsal it makes sense to hire an accredited organization to come and do a check in order to obtain PSO certification. In Serbia, for example, there are several printing companies that have complied their production with the ISO 12647-2 standard, but have not yet decided to verify with the help of the accredited organizations PSO certification.

We will now give an overview of the most important requirements in the printing company and preparations for printing prescribed by standards of the series ISO 12647, and for commercial and flexographic printing.

3. Presentation of the conditions prescribed by the standard for offset printing ISO 12647-2

At the end of 2004 the second edition of this standard was published, and still represents the basis for the PSO certification of commercial offset printing. However, in late 2013 the third edition was published, and has brought several significant changes. [7, 8]

Standard ISO 12647-2: 2004 defines a broad set of conditions that must be achieved in order to get the proof from the printing machine that was compliant with this standard:

- The properties of a raster structure (Line screens, screen dot shape, the angles of individual colors).
- Tolerances of dimensions between the individual separation.
- The total sum of the tonal values of raster (TVR) in the darkest places.
- Paper types, their optical properties and permitted tolerances.
- The sequence of colors in print.
- Referential CIE $L^* a^* b^*$ values of process (primary) colors (c, m, y, k), printed in full tone on standard paper and tolerances (deviation and variation).
- Referential CIE $L^* a^* b^*$ values of secondary colors, which are obtained by combining two full tones of the primary colors.

- TVR range reproduced in print.
- The tolerances in the positioning of some separation on the common imprint (tolerance reign of terror in color).
- Reference values to increase TVR on the print (Tone value increasing - TVI) in low ranges for standard paper types in certain situations and tolerances (deviation and variation on the proof sheet, approved during printing and print circulation).
- Referential dependency TVI of nominal TVR (reproduction curve) for different types of paper.
- TVR scattering in the midtones.

The third edition of this standard in 2013 brought considerable changes:

- Expelled is everything related to the application of the film.
- Altered are some of the requirements for the proof.
- The term “printing conditions” (Printing conditions - PC) is introduced, which includes the type of substrate, the spectral characteristics of color and tonal value increase foreseen date raster Line screens (AM raster) or point size (FM grid) in the press. Defined are eight printing conditions.
- A new classification of “print substrates” (Print substrates - PS) is made, which now are eight, and among them is a final and specially defined card for making boxes (PS3).
- Optical properties of a printing sheet are no longer normative but informative.
- Changed are also the reference of CIE $L^* a^* b^*$ values of the full tones of primary and secondary colors (Colorant description - CD).
- The reference values obtained by measuring on a white background (white backing) are not more informative but normative.
- Permitted values of deviation (variation and deviation) in full color of process color tones on the print of the reference values are given according to the equation ΔE_{2000} , but just as informative. Normative is still calculated according to the equation for ΔE_{ab} .
- There is a new systematization of the conditions for the spectrophotometric measurement (M1).

- Range of reproduced TVR on the print was expanded (considering that there is no copy from the film).
- Defined were new reference dependencies TVI of the nominal TVR (all reproduction curves) for different printing conditions. There are five (previously there were six) and are marked with large alphabet letters.
- New reference dependencies TVI of the nominal TVR are no longer defined only graphically (typically curvy line in the diagram), but also a table.
- A more precise determination of the allowed TVI on the print to a TVR, which was not given in the table is defined by equation (polynomial fourth degree) and coefficients to calculate for all five of the nominal dependencies TVI TVR.
- The increase in tonal values of raster for the black is equalized with other process colors.
- Scattering of TVR individual process color is no longer given only for the middle tone, but also for the tones less than 30% and greater than 60%.
- Specified are non-periodic raster structures.
- Defined are procedures for printing with integrated drying (UV, IR, heat-set).
- Defined is a way of determining whether the gray balance is achieved. The informational section is dedicated to achieve greater attention for printing conditions that lead to obtaining the gray balance.

The impression is that the third edition removed the lack of logic and brought detailed specifications where deficiencies in the previous version were pointed out. However, it still has not sufficient time passed since its adoption, so that the new ICC profiles can match the specifications of the new CD and TVI that are still in beta version. So, it is too early to be able to have a more detailed insight into the effects achieved with the new edition of ISO 12647-2: 2013, compared to the previous version. [9]

However, no matter which version of the standard is used, printers often face a number of technologically conditioned problems that interfere with compliance with the standards and require increased attention and efforts to eliminate, as will be discussed in the

next chapter.

4. Potencial problems for standardization in offset printing

Classical offset printing is based on the application of two fluids - printing inks and fluids for hydration, and indirect transfer of ink from printing form to the surface, via offset rubber. As the number of variables increases, the system is more complex and more difficult to keep under control, within the allowable limits. Here will be shown some of the problems that the authors encountered in their practice, during the harmonization process of offset printing from ISO standard.

- The low level of automation of the printing machine.

Printing machine must have a high degree of automation initial setup and control during printing runs. Theoretically, proof compliant with ISO standard can be obtained on a monochrome machine with a manual setting, but it requires a lot of time, which in a real production there is not. Thus, the ideal would be that a standardized printing machine which is is equipped with:

- o System presetting of color application by zones based on readings from "CIP" or TIF files.
- o Scanning spectrophotometer.
- o The system for automatic regulation of the paint coat by zones on the basis of measurement.
- o Automatic paser.

Thus equipped printing machine allows printing parameters to maintain close tolerances with any job regardless of the print run and whether the best or average machinis works with it.

- Using raw materials from reliable suppliers.

Some procedures (determination of the optimal color application, TVI, System of the setup proof) are made during the preparation for certification and subsequently at regular intervals or when changing suppliers of raw materials. If the ink or paper differ from delivery to delivery, the mentioned procedures must be done far more common than it was the case when there is a reliable supplier of the raw materials of uniform quality. In addition, the ink must enable a sufficiently small color deviations on the print, which is within the allowable standard.

- Condition in which there is a printing machine.

PSO certification is difficult to obtain if the machine was not in a technically good condition (on a scale from 1 to 5 the machine should be at least a strong 4). If the printing machine is in a poor condition it can lead to instability in production and the inability to achieve a relatively narrow tolerance prescribed by ISO standard. For example, if the supply of offset rubber is worse than those with which the proof for certification is printed, if they disrupt the work grabs on the impression cylinders, or the relationship between the cylinders in a printing machine system, it can all lead to an increased TVI in relation to the prescribed value by standards, or to the defects on the print, such as duplicating or moving, which a measurement device will also detect as increase of TVI.

- Fluids for hydration.

If the system for hydration does not dose well chemicals or can not maintain a constant water hardness, it will cause instability in production.

- Poor regulation of the atmospheric conditions in the printing company.

The temperature in the printing company should be $22 \pm 2^\circ \text{C}$, relative humidity $55 \pm 5\%$ [10]. In practice, especially in summer and winter, to achieve such strict tolerances is difficult, but as fluctuations are bigger, one can expect greater difficulty of maintaining constant printing conditions. Thus, for example, increasing the relative humidity slows the drying of paint, reduction leads to problems with the static electricity, lowering the temperature lowers the color intensity etc ... Changing the color changes the viscosity coefficient of ink that transfers to the surface and TVI, so all adjustments made on another temperature crumble.

- Resistance to application of standards or fire employees.

Some employees experience work according to strictly defined rules as destruction of their creativity or increased, unnecessary effort. In this case it may be concluded that standardization was not successfully implemented, because it was not essentially received by those who need to use the advantages that it brings. It is often the case (not only in printing companies) that after a while people relax, begin to assess what work needs to be done according to the rules, which can pass without measurement and they avoid to measure proofs and follow the proper procedure.

If the PSO certification is properly understood and consistently implemented, the benefits it brings are many, but there will be mentioned only the most obvious ones.

Through introduction of the presetting system and possibly automatic control of color application by zones, the duration of settings can be significantly shortened and the technological dependent of addition of color and paper machine adjustment can be reduced.

If a reliable soft proof is introduced, in which, first of all believes a typo, clients who come "for approval," do not have to enter the printing company.

Previous two effects can save several hours a day, which then can be applied to print and making profit.

The introduction of an organized system of work, in which every step is controlled will lead to the reduction of waste and the number of complaints.

Above mentioned effects of standardization are sufficient to feel the positive financial effects - higher profits in a not so long period of time.

The negative sides of standardization are that it demands increased engagement of a company that wants to standardize at some time, as well as financial investments. However, you should always watch forward, not just how much something costs, but how much benefit it can bring.

5. Review of conditions which are shown by the standard for flexographic printing ISO 12647-6

The standardization process for flexographic printing is much less advanced in the development of standardization than in offset printing, but there is not a corresponding ISO standard and its application procedures can be carried out on the model of offset printing. However, the concept of PSO was not introduced for flexo printing, but only the offset and gravure printing.

Existing standard ISO 12647-6: 2006 is by the structure very similar to the standard for the offset printing and prescribes a slightly smaller set of requirements [11]:

- Properties of raster structure (Line screens, dot shape and angles of the grid in certain separations).
- Tolerances on dimensions of some separation on

film or printing forms.

- The total sum of the tonal values of tone raster on the darkest places in the printout.
- Five types of substrates and their optical properties.
- Reference CIE L * a * b * values of process (primary) colors (c, m, y, k), printed in full tone in all five types of bases and tolerances (deviation and variation).
- Reference CIE L * a * b * values of secondary colors, which are obtained by combining two full tones of the primary colors.
- TVR range reproduced in print.
- The tolerances in the positioning of some separation on the common proof (tolerance reign of color fit).
- Reference values of TVR increasing on the print (Tone value increasing - TVI) in low ranges for standard types of surfaces and tolerances (deviation and variation) in the light (25%) medium (50%) and dark (75%) tones.
- TVR scattering in the midtones.

It is obvious that, due to the specificity and complexity of the procedure of flexographic printing, a set of defined conditions of printing is less and the tolerance is more free than in offset printing. However, practice has shown that the flexographic printing can be standardized in a similar way as offset printing, but taking into account the technological specificities that are explained in the next chapter.

6. Potential technologically determined problems of flexographic printing and benefits of standardization

In the flexographic printing are used:

- Printing inks of low viscosity.
- Anilox roller that transfers color from the bowl to the printing elements of the printing form.
- Printing Forms of photopolymer composition that with their mechanical properties look like rubber.
- Sticky ("duplofan") foils that are used for fastening the printing form on the form of body cylinder.

- Substrates for printing different origin, raw material composition, optical, surface and mechanical properties.

Harmonization of products with ISO standard in the printing of flexographic printing can be reduced to the following few steps:

- Determination of the optimal color application on the print to a deviation from the reference colors of standards within acceptable limits.
- Determination of TVI in the press in relation to the TVR on the printing forms.
- Correction of TVR on the RIP in order to comply with by ISO standard of TVI on the print compared to the nominal values of TVR.
- Check of color fit.
- System proof setup that gives color as the printing machine.

The main problem for the the standardization of flexographic printing is that it is difficult to maintain constant printing conditions over a longer period of time, for the following reasons:

- On most machines printing pressure is adjusted manually by the feel of the operator without the control of proof.
- Printing Forms must be extremely high and of uniform quality.
- The viscosity of paint must always be the same, which is not easy to accomplish without an automated system for dispensing solvents, which is rarely seen in printing companies. During printing, the solvent in the color evaporates, density and viscosity grow and it changes the coefficient of transmission of color, which leads to a change in appearance of the proof.
- Surface volume of the cell of anilox roll must be constant. To ensure this, it is necessary to clean the rollers in ultrasonic baths and check the volume of the cell transmission with a microscope which can measure the depth of the cells (the microscope is still a common occurrence from the automatic metering of the solvent). In addition, the volume of the cells changes as the anilox roller changes with time. This leads to a change in optical density of the full tone process color print so the print becomes paler.

- Double-sided adhesive foil which is fixed to the printing form cylinder has a significant role in reducing TVR on the print, so it is necessary to always use the same, and if they change, they must re-do the tests.
- Atmospheric conditions in the printing company of flexographic printing must be constant, identical to when the tests were made.
- Flexo printing is used for printing a large number of different materials, including, paper and cardboard, and in addition transparencies of various plastic and metal materials, most often aluminum. Printing companies working on a number of materials that behave differently in the printing machine have to do a large number of tests to comply the production with ISO standards.
- Harmonization of printing on foils with ISO standards depends largely on the application of covering white paint over or under other colors. It takes great technological discipline to do this base layer, which is an imitation of white paper that was uniformly printed in the long run.
- In the flexographic printing used are non-process colors, often in combination with the process colors, to correct limitations of procedures and expanded gamut, especially when during printing of packaging materials, printing of non-process colors is not processed by ISO standard.
- A particular problem is the preparation of the proof, which often needs to imitate printing on transparent material and metal foil. Simulating print on transparent material and non-process color printing simulation requires the use of specialized systems for the proofing.[<http://www.epson.com/cgi-bin/Store/jsp/Pro/SeriesStylusProWT7900/Overview.do?UseCookie=yes>], [<http://www.gmgcolor.com/products/flexoproof/>]

Therefore, precondition for compliance of flexographic printing with ISO standard is to achieve a high level of technological discipline and to keep stable printing conditions over a longer period of time. Printing inks that are used must be of high quality, or the printout will be given in small deviations from the reference values prescribed by the standard.

The main benefit of standardization of production is sorting the process of reproduction, which is in a large number of printing companies of flexographic printing rather chaotic, based solely on experience and unstable in the long term. With the introduction

of a reliable digital proof shortening the duration of machine adjustments and release this time for the productive work will be achieved.

7. Research of application of standards for offset and flexographic printing

In Bosnia and Herzegovina, on the introduction of standards (in particular ISO 9000 and other ISO 14000, ISO 18000, ...) has begun to work intensively after the war and with ten years of delay compared to other countries in the region [13]. Mainframes, as well as a number of smaller companies recognized the importance of introducing the quality system according to international standards of the series ISO, especially from the point of sale of their goods and services to foreign markets. It was founded by the Association for Quality in Bosnia and Herzegovina that is dealing with initiating, coordinating and organizing activities aimed at promoting the culture of quality in all areas of human activity, in accordance with national and international standards [12]. In Bosnia and Herzegovina, there are 31 consulting companies for the introduction of quality systems and 11 certificated companies operating on the territory of Bosnia and Herzegovina [13]. Quality Center of Foreign Trade Chamber of Bosnia and Herzegovina has, based on data obtained from certifying companies that operate on the territory of Bosnia and Herzegovina, made a database of certified organizations that refreshes monthly. From this database, which includes all activities (about 1,029 companies), it is evident that all these economic entities (9 printing) dealing with the graphics business have introduced the ISO 9001 quality management, two packaging manufacturers have introduced standard ISO 14001 for the implementation and maintenance of the environmental management system, and one introduced HACCP standard for preventive food safety [14].

The introduction of the ISO 9000 quality management system within the printing companies is adjusted to the international requirements for the systems of quality management in all business segments. However, ISO 9000 does not address the technical aspects of production, and is, for the modern printing company, insufficient to ensure the fulfillment of the increasingly complex demands of the modern, well-informed and very demanding customers. Therefore, it is necessary to introduce a group of technical standards, such as, for example, ISO 12647-2 for the offset printing.

In addition, for the preparation of the content of this work, a survey was carried out on the process of standardization of the printing companies of offset printing (49 interviewed printing companies), and the introduction of ISO 12647 or someone from the scope of ISO TC 130, or standards developed by FOGRA

(PSO, PSG and / or PSN). The analysis has revealed devastating results showing that a few printing companies use ISO 12647-2, or PSC (heat-set printing - FOGRA with appropriate ICC profiles according to the type of substrate (paper) to be printed on (SC, LWC, MWC etc ...).

Table 2. Number of certified printing companies according to the type of standards

Standard	Number of printing companies	
	certificated or which apply without a certificate	in the implementation phase
ISO 12647-2	1	1
FOGRA PSO	2	1
ISO 14001	2	1
ISO 14351	1	
FSC standard	1	1
OHSAS 18001	1	
HACCP	1	
Other standards	1	

The majority of respondents considered sufficient the introduction of quality standard ISO 9001, only one has introduced FSC standard for responsible forest management, and a few some are in the implementation phase of some of the standards (eg, ISO 14001, HACCP standards).

8. Conclusion

The process of standardization of printing companies in accordance with ISO standards has not gained momentum, except in some industrially most devel-

oped countries, such as Germany, Japan, Turkey and Austria.

In all countries of the former Yugoslavia, the largest organization for the PSO certification, FOGRA, has certified only seven printing companies.

The introduction of ISO standards in printing will significantly expand only if the contracting activities require the PSO certificate as a condition for providing work, and if managers of companies realize that their standardized production process provides an advantage over non-standardized competition.

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STANDARDIZACIJA OFSET I FLEKSO ŠTAMPE PREMA ISO STANDARDIMA

Sažetak

Objašnjen je pojam PSO kao nadgradnja u procesu standardizacije štamparije ofset štampe. Predložena je procedura po kojoj treba da postupi štamparija koja želi da svoju štampu usaglasi sa odgovarajućim ISO standardima. Analizirani su potencijalni problemi koji mogu otežavati standardizaciju zbog složenosti postupka flekso i ofset štampe. Dat je pregled noviteta koje je doneo standard ISO 12647-2 u verziji iz 2013 godine u odnosu na 2004. Analizirani su efekti koje može da donese usaglašavanje proizvodnje sa standardima. Analizirani su rezultati istraživanja primene standarda u štamparijama u Bosni i Hercegovini.

Ključne riječi: PSO, standardizacija, ofset štampa, flekso štampa

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