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ASSESSMENT OF THE RELIABILITY OF THE PRINTING OFFSET RUBBER BLANKET UNTIL THE TIME OF CANCELLATION WITH THE APPLICATION OF THE LABORATORY TEST SUDDEN DEATH TEST

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Abstract: *In this paper, 50 offset printing rubber blankets are reviewed and analyzed through measurements in terms of durability and physical properties, by assessing their reliability from the beginning of installation in the machine until their replacement by damage or withdrawal, in order to the machine to work with fewer defects.*

Specifically for printing rubbers, which are irreplaceable elements in graphics machines, durability in the work process is very important and characteristic for the machine to work without interruption in the specified time.

The necessary measurements for the research in this paper - the measurements of the durability of the printing rubber blanket have been successfully implemented on the printing machines in OFFSET PRINT DOOEL - Kicevo.

Because they test more data and in order to shorten the reliability assessment time we use a group laboratory test of the product known in the literature as the Sudden - Death Test.

Key words: *Reliability, offset rubber blanket, failure, Weibull.*

1. INTRODUCTION

Based on the definitions, the reliability of the offset printing rubber blanket used in the graphics offset industry as key elements, can be defined as the possibility with a certain level of confidence for the machine to successfully (without failure) perform the function for which it is intended, within at the estimated duration when it is used in a prescribed manner and for the purposes for which it is intended, but below certain levels of load, taking into account the previous time of its use.

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The rapid development of modern technologies indicates that the challenges faced by professionals who deal with hope continue to be great, especially when it comes to mechanical systems in which more software and electronics are present, ie systems with mechatronic components, such as modern graphics machines.

In our country, the theory of reliability has begun to be applied recently, because industrial production is at a very low level compared to developed countries, which means that reliability has not found proper implementation in factories and industrial production, let alone in the graphic industry.

2. GENERAL FOR PRINTING OFFSET RUBBER BLANKET

Offset printing rubber blanket is a critical component composed of several layers that has the role of transferring color from the matrix directly to paper or cardboard.

Offset printing rubber blankets used in printing in industrial graphics machines are classified into two groups as conventional and compression printing rubber blanket which must have the following technical characteristics according to the ISO printing standard 12636 described as follows:

- Thickness: 1.68 mm - 1.95mm.
- Width - Length size: If the size is less than 1 meter, the tolerance is ± 3 mm. If it is longer, it is 4 0.04 mm. On the smallest side the tolerance must be less than ± 0.02 mm, on the larger side the tolerance must be less than. 0.03 mm.
- Shape: The sides of the printing rubber blanket should have an angle (90 °) (perpendicular). Length of diagonals and difference in length between two parallel sides should not exceed 0.5%.
- Elongation: Must be less than 1.5%, in compliance with the ISO 12636 standard.
- Tensile strength: The tensile strength of all printing rubber blanket with a thickness of 1.68 mm and more must be higher than 40 N / mm.
- Thickness difference: The total thickness increase must not exceed a maximum of 4%, the thickness decrease must not exceed a maximum of 2% according to ISO 12636.
- Marking: Generally, on the back of the printing rubber blanket (outside the printing zone), there must be marked dimensions (thickness, length, width), an arrow-line mark indicating the direction of the printing rubber blanket that must be per cylinder,

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serial number, name of manufacturer or supplier and trademark of the printing rubber blanket.

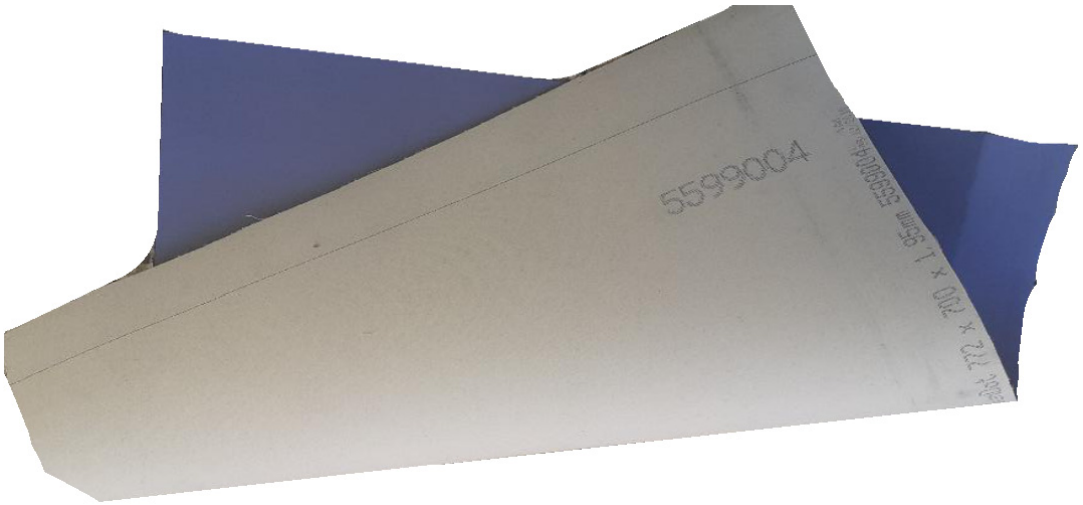

Fig. 1 Notes on thickness, width, length, and printer rubber blanket manufacturer and machine cylinder installation direction

One of the qualitative features of a printing press is its ability to last a long time, which deserves further examination. Printing rubber blanket installed on a printing machine usually last from 3 to 6 months, depending on the type of printing and the nature of the printing work, but it often happened that the printing rubber blanket also failed on the third print (impression) from many external factors, of which more frequent are: dust from the space, dust from the paper itself that appears from the cutting during the formatting of the paper, from the dried paint and from other solid objects that can be glued to the printing rubber itself from the thickness of the paper to be printed, and it often happens that the printing rubber blanket also fails the machine operator from improper installation and tuning and from defects during production or released as defective by non-branded manufacturers.

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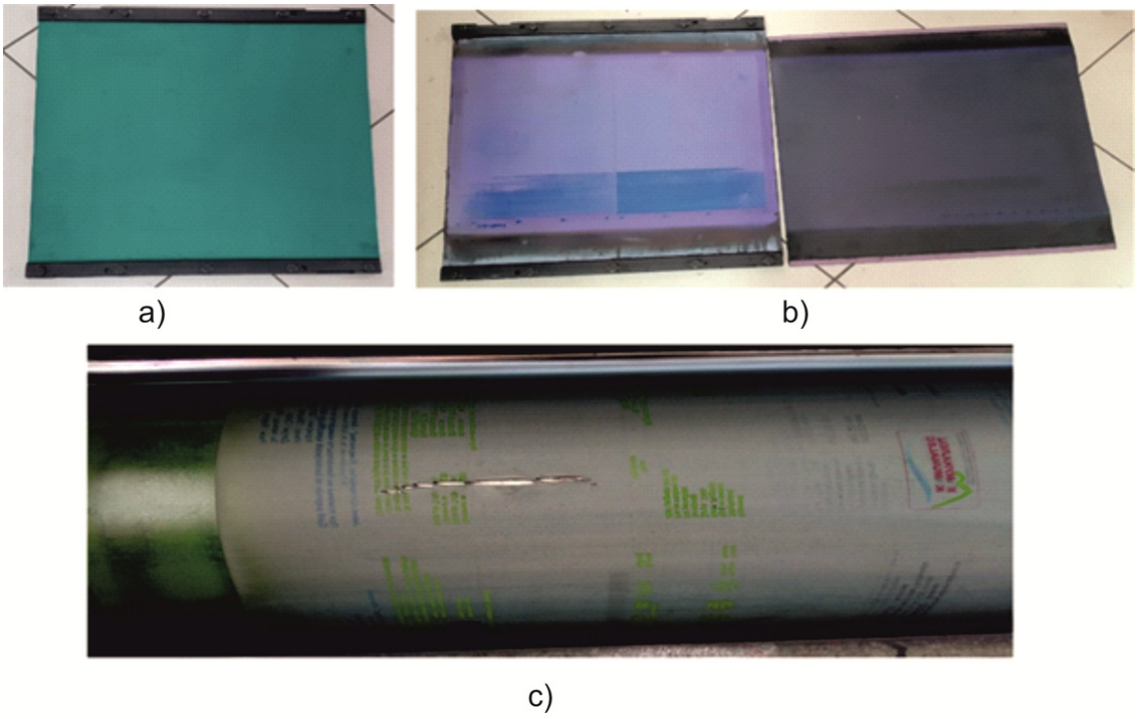

Fig. 2 a) New offset printing rubber blanket; b) Retracted printing rubber blanket as defective; c) Removed printing rubber from a crack (deformation) caused by mechanical force)

3. APPLICATION OF THE SUDDEN - DEATH TESTING FOR ASSESSMENT OF THE DURABILITY OF PRINTING OFFSET RUUBER BLANKET

Sudden - Death Test, is a method for group laboratory testing of products.

The Sudden - Death Test method, in theory, can be practiced only when all the time tests of the failure parameters are seriously clear and accurate, but in practice, it is noted that not all measurements of the continuous variables are accurate.

Table 1 shows the data of 50 offset printing rubber blanket from different manufacturers according to the number of impressions passed by the time of cancellation.

The measurements of the durability of these printing rubber blankets have been successfully implemented on the printing machines in OFFSET PRINT DOOEL - Kicevo.

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Table 1 Values for 50 impressive rubber blanket by the time of cancellation

128	153	165	170	174	177	185	194	203	215
140	158	166	170	175	178	189	195	205	220
145	158	167	172	175	179	189	197	207	221
149	161	168	173	176	182	192	199	208	223
151	163	168	173	176	183	193	202	210	235

x 1000 impressions

The average ordinal numbers in the group examination are:

$$i_{1=}i_0 + P_1;\ i_0 = 0;\ P_1 = \frac{50+1-0}{1+(50-0)} = 1.0;\ i_1 = 0 + 1.0 = 1.0$$

$$i_2 = i_1 + P_2;\ i_1 = 1.0;\ P_2 = \frac{50+1-1.0}{1+(50-5)} = 1.08;\ i_2 = 1.0 + 1.08 = 2.08$$

$$i_3 = i_2 + P_3;\ i_2 = 2.08;\ P_3 = \frac{50+1-2.08}{1+(50-10)} = 1.19;\ i_3 = 1.08 + 1.19. = 2.27$$

$$i_4 = i_3 + P_4;\ i_3 = 2.27;\ P_4 = \frac{50+1-2.27}{1+(50-15)} = 1.35;\ i_4 = 2.27 + 1.35 = 3.62$$

$$i_5 = i_4 + P_5;\ i_4 = 3.62;\ P_5 = \frac{50+1-3.62}{1+(50-20)} = 1.52;\ i_5 = 3.62 + 1.52 = 5.14$$

$$i_6 = i_5 + P_6;\ i_5 = 5.14;\ P_6 = \frac{50+1-5.14}{1+(50-25)} = 1.82;\ i_6 = 5.14 + 1.82 = 6.96$$

$$i_7 = i_6 + P_7;\ i_6 = 6.96;\ P_7 = \frac{50+1-6.96}{1+(50-30)} = 2.09;\ i_7 = 6.96 + 2.09 = 9.05$$

$$i_8 = i_7 + P_8;\ i_7 = 9.05;\ P_8 = \frac{50+1-9.05}{1+(50-35)} = 2.62;\ i_8 = 2.62 + 9.05 = 11.67$$

$$i_9 = i_8 + P_9;\ i_8 = 11.67;\ P_9 = \frac{50+1-11.67}{1+(50-40)} = 3.57;\ i_9 = 11.67 + 3.57 = 15.24$$

$$i_{10} = i_9 + P_{10};\ i_9 = 15.24;\ P_{10} = \frac{50+1-15.24}{1+(50-45)} = 5.96;\ i_{10} = 15.24 + 5.96 = 21.2$$

The ranks of the medians are:

$$F_1 = \frac{i_1 - 0.3}{N + 0.4} = \frac{1 - 0.3}{50 + 0.4} = 1.38\%$$

$$F_2 = \frac{i_2 - 0.3}{N + 0.4} = \frac{2.08 - 0.3}{50 + 0.4} = 3{,}53\%$$

$$F_3 = \frac{i_3 - 0.3}{N + 0.4} = \frac{2{,}27 - 0.3}{50 + 0.4} = 3{,}90\%$$

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$$F_4 = \frac{i_4 - 0.3}{N + 0.4} = \frac{3{,}62 - 0.3}{50 + 0.4} = 6{,}58\%$$

$$F_5 = \frac{i_5 - 0.3}{N + 0.4} = \frac{5.14 - 0.3}{50 + 0.4} = 9{,}60\%$$

$$F_6 = \frac{i_6 - 0.3}{N + 0.4} = \frac{6{,}96 - 0.3}{50 + 0.4} = 13{,}21\%$$

$$F_7 = \frac{i_7 - 0.3}{N + 0.4} = \frac{9{,}05 - 0.3}{50 + 0.4} = 17{,}36\%$$

$$F_8 = \frac{i_8 - 0.3}{N + 0.4} = \frac{11{,}67 - 0.3}{50 + 0.4} = 22{,}55\%$$

$$F_9 = \frac{i_9 - 0.3}{N + 0.4} = \frac{15{,}24 - 0.3}{50 + 0.4} = 29{,}64\%$$

$$F_{10} = \frac{i_{10} - 0.3}{N + 0.4} = \frac{21{,}2 - 0.3}{50 + 0.4} = 41{,}46\%$$

The test results and their processing are listed in Table 2.

Table 2. Impact rubber blanket failure time data, mean ordinal number and median rank

Ord. Number	Work until cancellation (impressions)	Products in cancellation	Correct products	Medium ord. nom.$i_{(t)}$	Median rank $F_i(\%)$
1	151000	1	4	1	1,38
2	163000	1	4	2,08	3,53
3	168000	1	4	2,27	3,90
4	173000	1	4	3,62	6,58
5	176000	1	4	5,14	9,60
6	183000	1	4	6,96	13,21
7	193000	1	4	9,05	17,36
8	202000	1	4	11,67	22,55
9	210000	1	4	15,24	29,64
10	235000	1	4	21,2	41,46

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The cancellation time data and the corresponding median rankings are plotted in the Weibull`s Probability Paper, followed by the points through which the cancellation allocation rights for the 50 print rubber blanket excerpt, shown in Figure 3, obtained in the Minitab statistical software program are withdrawn.

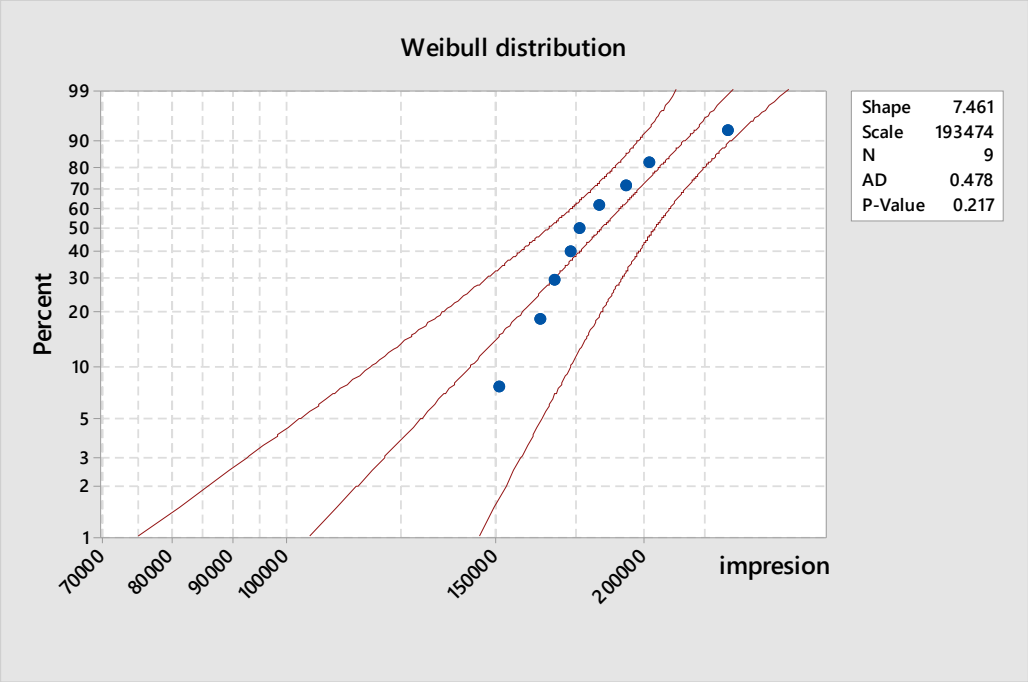

Fig. 3 Weibull distribution obtained according by the method Sudden Death test

Figure 3 shows that the cancellation distribution of the impressive rubber blanket tested is according to Weibull's distribution law.

4. CONCLUSION

For graphic offset machines, more specifically for printing rubber blanket as their primary component, their durability in the process of machine operation is very important and characteristic, so that the machine works without interruption in the defined time.

From the research for this paper it can be reasoned that the durability, ie the number of passed prints on the tested printing rubber blanket is not the same. Our conclusion is that, this is so for various reasons: defects and errors of various natures (mechanical, chemical, electrical), strong light that acts directly on the offset printing rubber blanket, the action of the operator

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manipulating the graphics machine, and there are certainly other reasons , which leaves room for further research.

REFERENCES

[1] Рика, С.: Примена на теоријата на надежноста за поставување модел за анализа на конкретен проблем во графичката индустрија,Битола, 2021

[2] Давчев, Т.: Надежност на техничките системи,Скопје, 1992.

[3] Давчев, Т : Надежност на техничките системи,Скопје, 2009.

[4] Kapur, C. K., Lamberson, R.L : Reliability in Enginering Desing, Jon Wiley & Sons. 1977.

[5] Polovko, A. M.: Fundaments of Reliability theory, Academic Pres., 1968.

[6] Birolini, A.:Reliability Engineering, Theory and Practice, Fifth edition- Springer.

[7] Ramović, R. M.: Pouzdanost sistema elektronskih, telekomuniakcionih i informacionih, Beograd, 2005.

[8] García,A.C., Papić, L.: Reliability modeling and prediction - Modelovanje i predviđanje pouzdanosti, Istraživački centar za upravljanje kvalitetom i pouzdanošću (The Research Center of Dependability and Quality Management) - DQM, Prijevor.

[9]Bernd, B.: Reliability in Automotive and Mechanical Engineering, Springer, 2008.

[10] Scholz, F.: Weibull Probability Paper. 2008.

[11] https://printplanet.com/threads/blankets-on-press.21326/

[12] https://www.birkan.de/pdf/en/BIRKAN-Aeropress-4ply-ND_025258_en.pdf/

[13] www.minitab.com

[14] http://printwiki.org/Blanket

[15] https://www.pressproof.com/Graphics_Library/printcncpts/printcncpts_h.html

[16] https://www.academia.edu/34704195/Required Characteristics of Blanket For Quality in Printing