FINDING RELIABILITY AND MAINTENANCE FOR THE MACHINERY OFMEN'S CLOTHING SEWING FACTORY IN NAJAF

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Abstract

This research addresses the subject of reliability and maintenance. Due to the expansion and development of industry and the many businesses related to it in real life it was necessary to delve into the processes of evaluating and calculating the performance efficiency of every system, its ability to work, and its capability to survive by addressing the two common concepts of reliability and maintenance in order to determine the degree to which the consumer or investor trust the machine or the device that serves them. The practical application was held in one of the productive factories in Iraq that is the Men's Clothing Production Factory/ in Najaf. And the data of processing time were collected from the sewing department. This will be further clarified in the practical part of the research where the average of reliability and maintenance of the sewing machinery sample by adopting the Exponential Distribution.

Keywords: *Negative Exponential Distribution, Availability, Reliability*

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1. INTRODUCTION

The amount of monthly production is mostly predetermined by the factory management without taking into consideration the (reliability and maintenance) capability of the machinery and equipment to produce. This leads to incidents of machinery failure which in terms leads to the delay of producing particular goods. Thus, the researcher finds the calculation of reliability and maintenance to be of great importance in the production process as a measure to the performance efficiency of machinery and equipment. The importance of the research lies in the fact that reliability and maintenance have a direct impact on the performance efficiency of machinery and equipment and their ability to work by prolonging their productive lives and reducing the costs of maintenance as the relationship between the reliability and maintenance and production time is one of the important things to determine the capability of any productive machine to fulfill the requirements of serving a product and delivering the product to the consumer fast and sound, by using scientific methods to calculate the machines' capability (reliability and maintenance) of production and by achieving high reliability and low rates of failure in a particular period of time. The aim of this study is to study the reliability and maintenance of machinery and equipment and determine the time for necessary maintenance to reduce chances of failure to minimum according to the available potency and within the machines' standard work conditions in the factory. In accordance with the aim of the study the following was hypothesized "the reliability of productive (sewing) machinery is determined according to its significant relationship with the performance efficiency of maintenance processes in the form of two indicators; the average time between two malfunctions indicator and the time required to fix machinery and equipment indicator. the men's clothing factory/ in Najaf was chosen as field and community for the research to study its distinctive role in producing clothes to various classes of the community in addition to being one of the leading industries in our country. The field study indicators focused on the men's clothing factory/ Najaf of this company for being one of its main modern factorys and which achieved outstanding results and obtained the quality certificate (ISO). The study period was limited by (September / 2016).The use of reliability method goes back to the studies done on the field of aircraft manufacturing post World War I due to the importance of pilot's safety during flight based on the use of electronic and mechanical devices. The work in this field has developed based on the development of the mathematical and statistical methods and the presence of computers and their magnificent ability to make many fast tests and processes.

The wide developed use of the reliability and maintenance method came as a result of their strong relationship to the industrial systems' performance age and their efficiency in addition to the necessary need to study and apply such hypothesis due to the scientific and technical growth in production, manufacturing, and designing fields. Many Arab and foreign researchers have dealt with the subject of reliability and maintenance, to mention some: In 1990 (Al-Tawash) estimated the machines reliability in the packaging department ofYafa juice factory in Baghdad/ Zaafaranya , as she used the parametric method which implies knowing the distribution so that Weibull distribution is applied from the time of operating the machines till the occurring of failure. In 1999 (Singh & Pensky)used the Bayesian method to estimate the function of reliability and average survival and

varying of the (Exponential, Gamma, Weibull) distributions. And in 2001 (MuhammedAdid Ali) used parametrically scaled estimation methods and the reliability function of the exponential distribution, scale parameter, shape parameter, and the reliability function for Weibull distribution. In addition, he used the estimation method to make a comparison for which of the traditional methods is the best, and the methods used for estimation are. Maximum Likelihood Method (MLE).Uniformly Minimum Variance Unbiased Estimator method (UMVUE).Bayesian Method. And it was found out that the (MLE) method is the best.In 2012 (iftikhar&Hussain) used Birnbaum-Saunders distribution in analyzing reliability of low Carbon Steel alloy, where the reliability function was estimated using the Maximum Likelihood Method in estimating distribution parameters, and the study was based on real life data.

2. RELIABILITY

The Concept of Reliability

The interest in studying reliability has increased after the technological development accompanied by a wide use of complex electronic systems and devices in different fields in life such as medicine, communication fields, and space research. These developments imposed an increasing interest in the studying the causes of failure and sudden malfunctions that different devices and machinery are exposed to, because an occurring failure leads to financial losses due to the increase of costs and the decrease of production, this made studying reliability a matter of great importance as it is an indicator to the efficiency of a machine and its ability to work without failure for a long time as well as the ability to assess the work and plan for future. Many researchers and specialists have tackled the concept of reliability and gave different forms of it, some of which are; the probability of one unit working a certain job under certain conditions and for a certain period of time. Or it is a measurement for the capability of any part of a certain system to work perfectly without stopping. And perhaps the most acceptable definition is that it is the probability of a machinery performing the purpose it was designed for properly, for a certain period of time, and under certain operational conditions.

Measuring Reliability

The indicators that can be used for measuring reliability are referred to as following

$$MTBF = E(T) = \int_0^\infty tf(t)dt) = \int_0^\infty R(t)dt \ldots\ldots\ldots\ldots\ldots\ldots (1-2)$$

Mean Time Between Failures (MTBF)

It is the average time between the failures occurring in the machine or one of its repairable and unrepairable parts, the more the value of the average increases the more the Availability of the machine increases, all this indicates the high efficiency of maintenance.[1],[2],[6]

Mean Time To Repair (MTTR)

It is the average of time needed to repair the machine after failure, the more the value of this average raises the more it indicates a decrease in Availability of the machine and a decrease in the efficiency of maintenance.[2]

Failure Rate

It is the probability of prolonging the work of a certain machine until the occurrence of failure. The concept of failure rate is used do differentiate between different distributions. It is known in the study of reliability as the Hazard Rate.[5]

$$h(t) = \frac{f(t)}{R(t)}$$

Availability

It is the ratio of Mean Time Between Failures MTBF to the sum of (MTBF + the Mean Time to Repair MTTR) .[1]

$$Availability = \frac{MTBF}{MTBF + MTTR} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2-2)$$

Reliability Function

From the indicators above the reliability can be calculated where:

$$R(t) = \frac{f(t)}{h(t)}$$

R(t) reliability function
f(t) the probability density of failure times
h(t) average of failure

Negative Exponential Distribution

The exponential distribution is a special case of Gamma Distribution as well as of Wieblle distribution when the value of β=1, which is considered as one of the most important continuous distributions due to its vast use, since the random variable in it uses the time. As when the random variable refers to time taken to obtain n productive units, the time taken to complete a certain job, waiting time, or any other of the many applications.[2][7]

$$f(t) = \begin{cases} \lambda \exp(-\lambda t) & t > 0, \lambda > 0 \\ 0 & o/w \end{cases}$$

The forms below represent both the reliability and distribution function cumulative function:

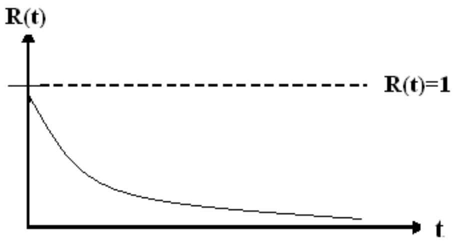

Fig 1-2: Represents a diagram reliability function

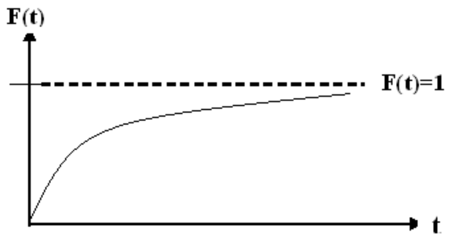

Fig 2-2: Represents cumulative distribution function diagram

Estimating The exponential distribution parameter (using Maximum Likelihood Method)

This method's goal is to give the maximum value to the function of maximum likelihood of the random variables. This method is mostly used to estimate distributions parameters because it gives good characteristics to the estimator and is more accurate than the other methods especially when increasing the volume of the sample.[1]

$$f(t) = \lambda \exp(-\lambda t)$$

$$Lf(\lambda; t_1, t_2, \ldots\ldots\ldots, t_n) = \prod_{i=1}^{n} \lambda \exp(-\lambda t)$$

$$\hat{\lambda} = \frac{1}{\bar{t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3-2)$$

Some Benefits of Maintenance

1- Enhance safety: good maintenance insures the safety of the users of machines by reducing the risks caused by them.
2- Increasing the reliability of the system and machinery by reducing the time lost along the production line, reducing failures, and decreasing deviation in production rates.
3- Contributing in creating high quality as poor maintenance of equipment leads to lowering the performance according to the specified standards.
4- Reducing operational costs by increasing the efficiency level of machinery and equipment and shortening failure times and their repair.
5- Prolonging the life of the assets by reducing problems and suffocations that may occur during operation and preventing them from worsening.
6- Good maintenance contributes in achieving high market value of the machines if they are sold.

Maintenance is classified into different types:
a- Circumstantial maintenance: determined when the equipment need it, and it includes testing, inspection, and constant observation of machinery.
b- Designing for maintenance: it means designing the parts that need to be replaced and maintained to contribute in the reliability of performance.
c- Reliability based maintenance: determining what needs to be done to insure the continuous work of machinery with minimum stops as a result of concentrating on providing high reliability of machinery and working on eliminating the causes of failures.
d- Comprehensive productive maintenance by the collective contribution of the different departments of the productive organization in order to improve the quality of machinery and reducing losses and costs.
e- Remedial maintenance: also known as maintaining failures, which is repairing machinery when the failure occurs according to priority and emergency.
f- Preventive maintenance: it a programmed and organized work to detect the obstacles that may affect the machine or the system.

The practical Application

Introduction

this section will take a brief review of the productive base of the factory and explain the technological path of the production process in the factory as well as the study samples (sewing department) and a table showing all the types of machinery used in the production, and finally showing the results of the practical application of reliability and maintenance for the General Company of Textile Industry/ men's clothing factory in Najaf.

Brief review of men's clothing factory in Najaf

The factory was opened in 15/10/2011 and the machinery in sewing department were made in (2010) as shown in table (1).

1- The productive base of the factory:

The factory comprises the following departments:

1- Design department: this department is responsible for the modern designs and the make of complementary templates and patterns.

2- Control department: this department is responsible for controlling the product during operation stages in the preparation and sewing departments along with inspecting textile and equipment in labs and approving templates and patterns.

3- Preparation department: the department responsible for tailoring products according to the designs and models issued by work orders.

4- Programming department: responsible for issuing work orders regarding textile and equipment.

5- Sewing department: responsible for sewing products and different models.

6-Maintenance department: responsible for maintaining machinery and tools in the factory.

2-Technological path:the technological path has been proposed by meeting with the planning department official in the factory.

1- Designing the suit model, model No.
2- Ratification of the model by a specialized committee.
3- Preparationof special templates and of different sizes.
4- Issuing work orders by the programming department.
5- Designing work orders in the preparation department.
6- Technical distribution of production lines that is executing the model.
7- Inputting orders from the product in sewing department for the purpose of training and monitoring by technology and control.

Table 1: Shows the types of machines used in the sewing department.

make	model	Type of machine	No.
PfaffGermany	2438	Zgzag	1
Storbel	K103-161	Goose blind	2
Durkopp	745-34-2A	Sewing and open pocket	3
Durkopp	251	Ordinary sewing	4
Durkopp	275	Sew with the embroidery	5
Durkopp	550 -12	Sewing on the sleeves	6
Shda	782NP	Decorative Sewing jacket	7
Pfaff	LX2-630	Sewing Kwak	8
Juki	DMN-5420	Sewing + knife Tarah	9
Juki	LK1900	Sewing strengthen type	10
Juki	550 – 8 – 3	Sewing type Zenjal	11
Storbel	K310D	Sewing the bottom of the jacket blind stitch type	12
Ress	S 4000	Sewing buttons site	13
Juki	LK 1903	Install buttons site	14
Durkopp	697	Sewing Ctavih	15
Macpi	517 – 300	Laundry	16
Juki	Mo 6704	Sewing Ofer	17
Macpi	333-00-0200	Glued cloth	18
Storbel	KL 218D	Sewing Aleachh	19
Storbel	K103-258	Sewing Alhbasih	20

Collecting Data

The data has been collected during the time of operating machinery in maintenance department (research sample). The sample constitutes a percentage of 15% of the original community. And the machinery chosen for the study of reliability are as following:

1- Zigzag machine model:2438 made by the German company Pfaff.
2- Ordinary sewing machine, model: 251 made by Durkopp.
3- Buttons installation sewing machine model: LK1903 made by Juki.

The operation times were taken from Sun/ 3rd Sep. 2016 to Thur/ 28th Sep.2016.

The questionnaire sample used in the field study is explained in the attachment. Where the equation (1-2) was used to calculate Reliability and the equation (2-2) to calculate Availability.

Tables for Calculations and Results

Table 2: Average hours of daily shows to engage in the type of sewing machine ZG ZAG modl: 2438 made German company for a month and shown the reliability values (productivity) and the proportion of risk

Weeks	days	No. Hours works	Ratability	Failure	
Week1	Sun.	7.25	91%	9%	
	Mon.	7.45	93%	7%	
	Tus.	7.50	94%	6%	
	Wed.	6.30	79%	21%	
	Thr.	7.45	93%	7%	R_t = 91.3%
Week2	Sun.	7.30	91%	9%	f_t = 8.7%
	Mon.	8	100%	0%	
	Tus.	7.35	92%	8%	
	Wed.	6	75%	25%	
	Thr.	7.40	93%	7%	

Week3	Sun.	8	100%	0%	
	Mon.	7.45	93%	7%	
	Tus.	7.25	91%	9%	
	Wed.	6.30	79%	21%	
	Thr.	7.50	94%	6%	
Week4	Sun.	7.45	93%	7%	
	Mon.	6.50	81%	19%	
	Tus.	8	100%	0%	
	Wed.	7.50	94%	6%	
	Thr.	8	100%	0%	

Table 3: Average hours of daily shows to engage in an ordinary Sewing machine modl: 251 Make Durkopp for a month and shown the reliability values (productivity) and the proportion of risk

Weeks	days	No. Hours works	Ratability	Failure	
Week1	Sun.	7.30	91%	9%	
	Mon.	8	100%	0%	
	Tus.	7.50	94%	6%	
	Wed.	8	100%	0%	
	Thr.	7.20	90%	10%	
Week2	Sun.	8	100%	0%	
	Mon.	8	100%	0%	
	Tus.	7.30	91%	9%	
	Wed.	7.50	94%	6%	
	Thr.	6.30	79%	21%	R_t = 93.25%
Week3	Sun.	7.45	93%	7%	f_t = 6.75%
	Mon.	7.15	89%	11%	
	Tus.	6.50	81%	19%	
	Wed.	8	100%	0%	
	Thr.	8	100%	0%	
Week4	Sun.	8	100%	0%	
	Mon.	7.20	90%	10%	
	Tus.	7.15	89%	11%	
	Wed.	7.00	88%	12%	
	Thr.	7.50	94%	6%	

Table 4: Average hours shows engage in daily sewing machine installed Aldkmhmodl: LK1903 Make Juki for a month and shown the reliability values (productivity) and the proportion of risk

Weeks	days	No. Hours works	Ratability	Failure	
Week1	Sun.	8	100%	0%	
	Mon.	7.30	91%	9%	
	Tus.	7.15	89%	11%	
	Wed.	6	75%	25%	
	Thr.	7.30	91%	9%	
Week2	Sun.	7	88%	12%	
	Mon.	7.30	91%	9%	
	Tus.	7.50	94%	6%	
	Wed.	8	100%	06%	
	Thr.	7.40	93%	7%	R_t = 90.55%
Week3	Sun.	7.35	92%	8%	f_t = 9.45%
	Mon.	7	88%	12%	
	Tus.	6.30	79%	21%	
	Wed.	8	100%	0%	
	Thr.	7.50	94%	6%	
Week4	Sun.	5.50	69%	31%	
	Mon.	7.20	90%	10%	
	Tus.	7.40	93%	7%	
	Wed.	8	100%	0%	
	Thr.	7.50	94%	6%	

Table 5: hows the availability of the machines under study

S	MTBF+MTTR	MTTR	MTBF	Total repair machinery Times /hours	Total hours engaging	Total failure times (hours)	Number of failures	Machine productivity	ت
98%	**13.09**	**0.21**	**12.88**	**2.5**	**154.5**	**5.5**	**12**	ZIG ZAG type Sewing machine	**1**
97%	**12.10**	**0.27**	**11.83**	**3.5**	**153.85**	**6.15**	**13**	An ordinary sewing machine	**2**
96%	**9.69**	**0.38**	**9.31**	**6.15**	**148.9**	**11.1**	**16**	Sewing machine to install buttons	**3**

3. RESULTS AND CONCLUSION

By observing the results it is noticed that Reliability of the three types of sewing machines ranges between 90.55% and 93.15% taking into consideration that the machines are newly manufactured; model 2010. This indicates that operation life will decrease by the passing of time.

The most important recommendations to be mentioned in the light of the obtained results from calculating the data collected from maintenance department and all the notes taken we hereby put some recommendations before the sewing department which help to overcome the obstacles they may face.

REFERENCES

[1] Khazraji, Ahmed Abdel Ali Akkar, (2001). Compared to the methods of estimating the full reliability of the data using simulation with practical application, Master Thesis, University of Mosul, Faculty of Computer Science and Mathematics.

[2] Moussawi, Asil Ibrahim Mohsen, (2000). Programming preventive maintenance using databases, Master Thesis, University of Baghdad, College of Management and Economics.

[3] Defa'ay, Iftikhar Ali Hussein and Hussein Ali Hussein, (2012) "The use of the distribution Birenbam Sanders in finding the reliability of low-carbon steel alloy practical application" Search has been discussed in the Conference / second for the College of Administrative technical / Baghdad.

[4] Ali, Abdul Sattar Mohammed, Production and Operations Management - Quantitative Approach, Daroail for publication, Oman 0.2000.

[5] Tawash, Mason Tawash Salem, (1990), "Statistical study of extreme reliability and value with practical application," Master Thesis, University of Baghdad, College of Management and Economics.

[6] Singh And Pensky (1999) , (Empirical Bayes Estimation Of Reliability Characteristics For Exponential Family) . The Canadian Journal Of Statistics, V.27 , No.1 P-127 .

[7] Sinha , S.K. And Kale , B.K. (1980) ,(Life Testing And Reliability Estimation) . Wiley Eastern Limited.