VIBRATION STUDY TO IMPROVE STRIPPING OPERATION IN A LITOGRAPHICS COMPANY

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RESUMEN: En una empresa dedicada a la impresión y elaboración de cajas y precisamente en la operación de striping. o desbarbe que es donde se cortan los excesos o sobrantes de las cajas después del proceso de sauje (marcado o preformando por medio de prensas), nos encontramos que en esta operación los trabajadores se encuentran expuestos a los mas importantes factores de riesgo ocupacional como son frecuencia, esfuerzo energético y mala postura, pero sobre todo a una sobreexposición de vibración producida por un roto martillo neumático utilizado para quitar el cartón sobrante o la rebaba de las cajas durante la operación de striping, y es por esto que en esta investigación se analizo el uso de dicha herramienta y se vio que al utilizar un aislante adecuado en el mango del roto martillo neumático y los guantes ergonómicos anitimpacto y antivibración en vez de los de algodón que actualmente proporciona la empresa se reduce al máximo el estrés de trabajo producido por la vibración, así como también al utilizar el equipo de protección personal consistente en tapones auditivos, mascarillas y zapatos de seguridad se mejora considerablemente el entorno del operador y así se podrá reducir considerablemente el riesgo de adquirir una enfermedad profesional generada por el tipo de trabajo requerido por el proceso de fabricación del producto.

Palabras Clave*:* Vibracion, Equipo de protecion personal.

ABSTRACT: The comparative study was made in a company dedicated to fabricate and print carton boxes. After the carton press forming process there is an operation that removes carton excess and leftovers which was found that workers are exposed to an occupational risk

conditions like frequency, body stress and bad postures besides of an overexposure vibrations condition originated from a pneumatic roto-hammer utilized to remove carton leftovers during the stripping operation , and that is why this investigation was focused in the use of this pneumatic tool. After a close analisys of the situation it was found that by adding the proper insulation to the tool handle and by using anti-impact / anti-vibration ergonomic gloves instead of the normal cotton gloves provided by the company, the stress condition due to the tool vibrations was drastically reduced, in addition to this the personal protection equipment was improved by utilizing ear plugs, mask and safety shoes, and as a result of these actions the work environment conditions were improved thus reducing the probability of getting a body trauma due to the fabrication process needs.

Key words*:* Vibrations, Personnel Protection Equipment*.*

1. INTRODUCTION

After the carton Fabrication and Printing process there is a stripping operation which consists of two steps: carton preforming by utilizing a pneumatic roto-hammer and manual removal of leftovers from cartons located on pallets, figures 1.1 and 1.2 below show the fabrication process sequence.

Figure 1.1 Preforming of boxes using the pneumatic roto- hammer

Figure 1.2 Manual carton leftovers removal.

In the operation mentioned above it was found that the workers were exposed to significant occupational risk conditions such as frequency, body stress and anti-ergonomic postures and also an overexposure to vibrations for extended periods of time affecting arms and hands due to the use of this roto-hammer tool, the workers were just using normal cotton gloves, also a survey was made finding that workers suffer from chronic back ache, weakness sensation of hand grasping ability known as Accumulative Trauma Disorder (ATD) in tendons and nerves which was developed due to this working condition for an extended period of time.

2. INVESTIGATION METHODOLOGY

Investigating carefully to get the proper analyzing data in order to improve this workstation, a Vibrations meter was used (Bruel & kkjaer"s model vibrotest 60 shown in figure 2.1). Vibrations readings were taken using just regular cotton gloves as shown in figure 2.2 to make the comparisson against utilizing anti-impact / anti-vibrations ergonomic gloves and also an insulator material was installed on the roto-hammer handle to help improving this situation. Finally the readings were taken on both conditions and they are shown on the following tables .

Figure 2.1 Vibrations Analyzer Utilized in the study

Figure 2.2 Vibrations readings taken at Stripping work station.

The data was carefully analyzed and charts were obtained to compare before and after conditions (1 µm = .001 mm = 1 x 10^{-3} mm measuring units were used) , without cotton gloves, with cotton gloves, with anti-impact / anti-vibtations gloves and last the insulation on the tool handle.was added. Chart figure 2.3 shows this data.

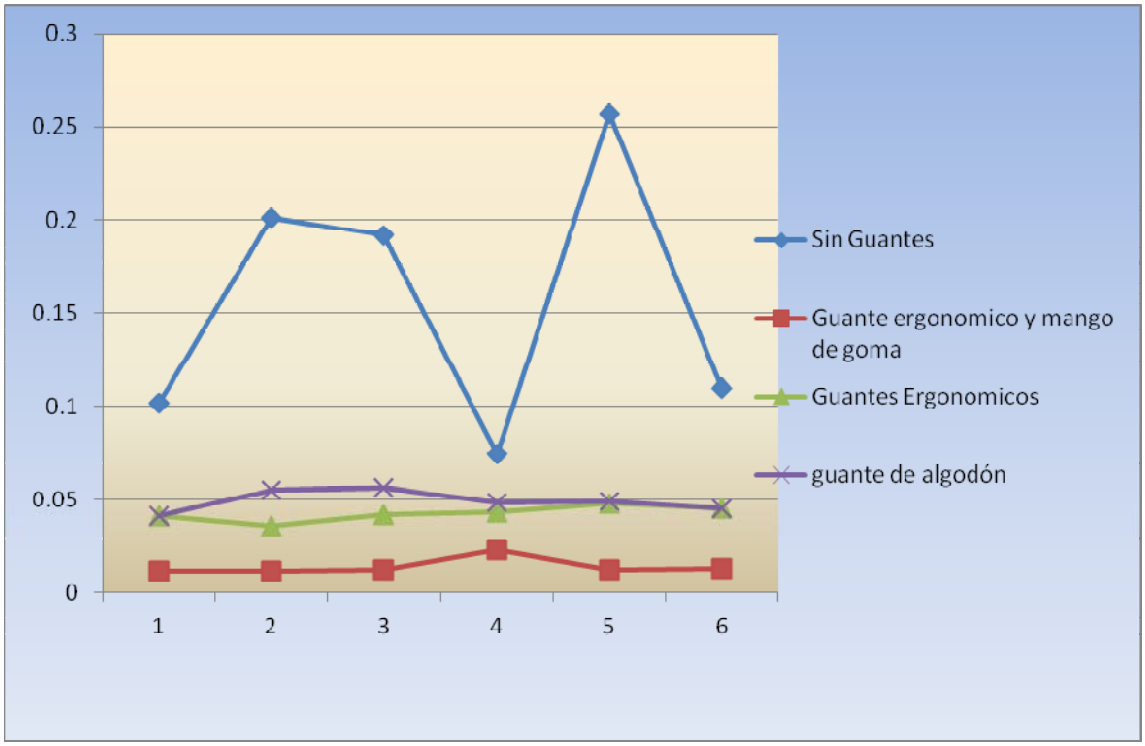

Figure 2.3 This chart shows the average of vibration readings using this analyzer . without gloves (blue), with cotton gloves (purple), With ergonomic gloves (green), with both ergonomic gloves and handle insulation (red).

ANALIZADOR DE VIBRACION MODELO BRUEL & KJAERVIBRO
Lecturas tomadas sin guantes.

Toma de lectura #1	
um	0.001
	0.117
PP	0.116
	0.114
BCU	0.117
	0.116
	0.117
	0.118
PROMEDIO	0.102

Toma de lectura #2	
um	0.002
	0.26
PP	0.24
	0.24
BCU	0.23
	0.22
	0.18
	0.24
PROMEDIO	0.2015

Toma de lectura #3	
um	0.001
	0.17
PP	0.27
	0.18
BCU	0.28
	0.19
	0.24
	0.21
PROMEDIO	0.192625

Toma de lectura #4	
um	0.01
	0.087
PP	0.086
	0.084
BCU	0.083
	0.08
	0.082
	0.084
PROMEDIO	0.0745

Toma de lectura #5	
um	0.003
	0.28
PP	0.27
	0.28
BCU	0.29
	0.32
	0.3
	0.31
PROMEDIO	0.256625

Toma de lectura #6	
um	0.002
	0.13
PP	0.12
	0.14
BCU	0.13
	0.18
	0.16
	0.019
PROMEDIO	0.110125

Toma de lectura #7	
um	0.001
	0.12
PP	0.15
	0.11
BCU	0.1
	0.14
	0.16
	0.18
PROMEDIO	0.120125

Toma de lectura #8	
um	0.03
	0.04
PP	0.11
	0.18
BCU	0.23
	0.04
	0.25
	0.28
PROMEDIO	0.145

Toma de lectura #9	
um	0.01
	0.04
PP	0.13
	0.18
BCU	0.24
	0.22
	0.26
	0.24
PROMEDIO	0.165

CON GUANTES

Toma de lectura #1	
um	0.002
	0.015
PP	0.013
	0.014
BCU	0.012
	0.015
	0.012
	0.011
PROMEDIO	0.01175

Toma de lectura #2	
um	0.001
	0.044
PP	0.045
	0.043
BCU	0.042
	0.043
	0.042
	0.041
PROMEDIO	0.037625

Toma de lectura #3	
um	0.001
	0.044
PP	0.066
	0.063
BCU	0.07
	0.075
	0.07
	0.074
PROMEDIO	0.057875

Toma de lectura #4	
um	0.001
	0.029
PP	0.037
	0.048
BCU	0.052
	0.053
	0.057
	0.052
PROMEDIO	0.041125

Toma de lectura #5	
um	0.003
	0.016
PP	0.014
	0.018
BCU	0.012
	0.021
	0.024
	0.021
	0.018
PROMEDIO	0.01633333

Toma de lectura #6	
um	0.002
	0.015
PP	0.016
	0.018
BCU	0.019
	0.022
	0.024
	0.027
PROMEDIO	0.017875

Toma de lectura #7	
um	0.002
	0.072
PP	0.071
	0.068
BCU	0.07
	0.073
	0.079
	0.08
PROMEDIO	0.064375

Toma de lectura #8	
um	0.001
	0.015
PP	0.022
	0.024
BCU	0.028
	0.029
	0.027
	0.029
PROMEDIO	0.021875

Toma de lectura #9	
um	0.001
	0.024
PP	0.023
	0.026
BCU	0.028
	0.023
	0.026
	0.025
PROMEDIO	0.022

CON GUANTES Y SIN AISLANTE EN MANGO

Toma de lectura #1	
um	0.001
	0.01
PP	0.008
	0.015
BCU	0.009
	0.013
	0.012
	0.011
PROMEDIO	0.009875

Toma de lectura #2	
um	0.001
	0.012
PP	0.013
	0.01
BCU	0.013
	0.01
	0.012
	0.012
PROMEDIO	0.010375

Toma de lectura #3	
um	0.001 Micrometros
	0.012
PP	0.01
	0.011
BCU	0.009
	0.048
	0.053
	0.054
PROMEDIO	0.02475

Toma de lectura #4	
um	0.001
	0.04
PP	0.048
	0.046
BCU	0.047
	0.05
	0.054
	0.058
PROMEDIO	0.043

Toma de lectura #5	
um	0.001
	0.046
PP	0.048
	0.054
BCU	0.058
	0.056
	0.058
	0.059
PROMEDIO	0.0475

Toma de lectura #6	
um	0.001
	0.045
PP	0.047
	0.048
BCU	0.052
	0.051
	0.058
	0.059
PROMEDIO	0.045125

CON GUANTES Y CON AISLANTE ADHERIDO A ROTOMARTILLO

Toma de lectura #1	
um	0.002
	0.015
PP	0.016
	0.018
BCU	0.011
	0.01
	0.013
	0.012
PROMEDIO	0.012125

Toma de lectura #2	
um	0.001
	0.012
PP	0.012
	0.013
BCU	0.014
	0.011
	0.012
	0.013
PROMEDIO	0.011

Toma de lectura #3	
um	0.001
	0.012
PP	0.01
	0.011
BCU	0.01
	0.013
	0.015
	0.018
PROMEDIO	0.01125

Toma de lectura #4	
um	0.002
	0.02
PP	0.01
	0.019
BCU	0.018
	0.017
	0.018
	0.01
PROMEDIO	0.01425

Toma de lectura #5	
um	0.001
	0.07
PP	0.013
	0.012
BCU	0.01
	0.014
	0.012
	0.013
PROMEDIO	0.018125

Toma de lectura #6	
um	0.002
	0.012
PP	0.013
	0.015
BCU	0.016
	0.018
	0.012
	0.014
PROMEDIO	0.01275

Toma de lectura #7	
um	0.003
	0.055
PP	0.054
	0.052
BCU	0.054
	0.048
	0.052
	0.055
PROMEDIO	0.046625

Toma de lectura #8	
um	0.001
	0.048
PP	0.05
	0.046
BCU	0.047
	0.053
	0.052
	0.05
PROMEDIO	0.043375

Toma de lectura #9	
um	0.001
	0.04
PP	0.044
	0.04
BCU	0.044
	0.042
	0.037
	0.032
PROMEDIO	0.035

3. RESULTS

Based on the detailed ergonomic analysis made and considering the vibrations condition that the regular worker is exposed to during extended periods of time , It is strongly recommended to re-design and relocate this work station to make it safer and easier to handle the material used , and also it is suggested to break-down this operation in two steps physically separated from each other (pre forming and manual leftovers removal as shown in figure 3.1) in order to rotate operators every two hours in each step of the operation , place an anti-fatigue floor mat and at the same time insulating the handle of the roto-hammer pneumatic tool (figure 3.2) and also utilizing anti-vibrations / anti-impact ergonomic cotton gloves / spandex and with akton material on the hand palm area to reduce the vibrations impact (figure 3.3), in addition to that , safety shoes with steel must be used at all times , as well ear plugs, and mouth mask to avoid contact with the carton dusts.

. BEFORE AFTER

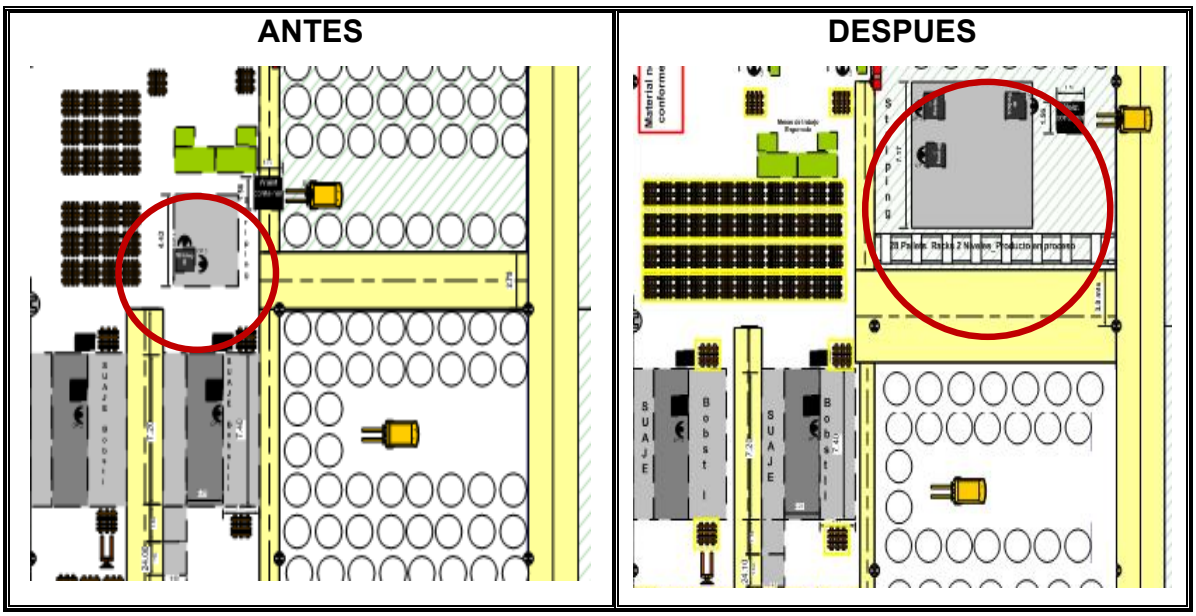

Figure 3.1 Layout of the stripping operation before and after the improvement showing the operation separated in two steps and physically separated also.

Figure 3.2 Insulation of tool handle

Figure 3.3 Anti-vibration/impact gloves

4. CONCLUSIONS

The level of vibration due to the use of certain tools can be reduced to avoid a higher damage to the human body by taking several actions like rotation of workers (Administrative controls) more often , proper maintenance of tools to prevent malfunctioning, Installation of anti fatigue floor mats to isolate vibrations from human body,Anti-vibration devices like plastics or foams adapted to the tools or machines (Engineering controls). And also the use of personnel protection equipment like anti-vibration / anti-impact gloves. The lesson learned from this study , most important from all this, is to change or improve Company's safety practices culture to protect workers by meeting Official Mexican Safety Norms (nom 017 and nom 024) at the workplace, and to train , and implement awareness programs aim to employees through visual and verbal communications medias to make them aware of the possible body damage due to long exposure of vibration conditions resulting in possible traumas. **(Human administrative controls).***

* Mario Ramirez Barrera (UACJ 2010)

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