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NOISE ASSESSMENTS IN A CARPENTRY WORKSHOP

Ioana Alexandra MUSCĂ, Diana Ioana POPESCU, Nicolae URSU-FISCHER, Andrea VASS

Abstract: *This paper presents some results of the measurements carried out level in the carpentry workshop of the Technical University of Cluj-Napoca in order to assess the noise levels. Measurements were performed according to STAS 7150-72 that refers to the methods of sound level measurement in the industrial area. Data were correlated to H.G.493/12.04.2006 concerning minimum requirements for safety and health, relating to the exposure of workers to the risks generated from noise.*

Key words: *noise measurements, carpentry workshop, industrial area, sound level, risks from noise exposure*

1. INTRODUCTION

The woodworking industry has experienced noise level increases as a result of modern, higher speed, and more compact machines. The basic noise elements in woodworking machines are cutter heads and circular saws [1], [2], [3].

Equivalent sound pressure levels (LAeq) in the furniture manufacturing industry can reach 106 dB(A). Woodworking machinery uses operations, such as cutting, milling, shaping, etc. Three basic noise sources are involved:

- Structure vibration and noise radiation of the work piece or cutting tool (such as a circular saw blade) and machine frame, especially at the mechanical resonance frequencies.
- Aerodynamic noise caused by turbulence, generated by tool rotation and the workplace in the air flow field.
- Fan dust and chip removal air carrying systems [2], [4], [5].

The noise of the carpentry workshop presented in this study creates discomfort for workers, which complained several times asking for the improvement of the noise environment. For this purpose a noise study was made, starting with measurements carried out to record the sound level inside.

Measurements were made according to STAS 7150-72, which refers to the methods for measurement of the sound level in industry, produced by installations, equipments or machines in the space designated for industrial activity and in the outer area [7].

2. MEASUREMENT PROCESS

The carpentry workshop of the Technical University is located on Dorobantilor Street, no. 71-73, Cluj-Napoca. Figure 1 presents the positions of the measurement points inside the main room of the workshop – five measurement points. Images from the carpentry workshop are presented in figure 2, defining each measurement point.

The position of each point was chosen in order to respect the following principle: the distance between two points of measurement should be less than 15 m; the distance between a point of measurement and the wall should be less than 5 m.

Measurements were made on December 5, 2012 and the time interval for each of them is presented in table 1.

In figure 1 one may see the outline of the carpentry workshop with the location of the working equipment and the placement of the measurement points. Figure 2 shows that during the noise recording workers did their daily activity.

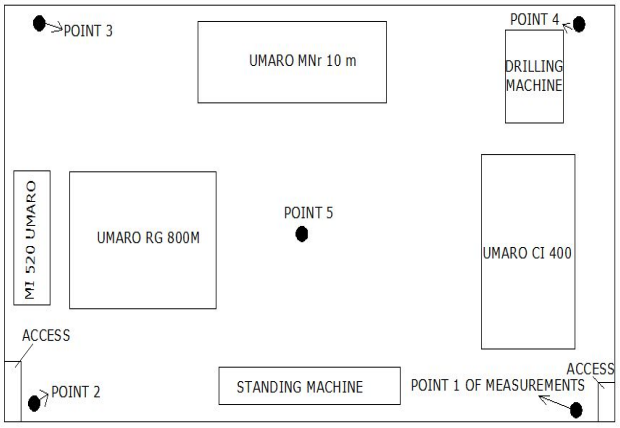

Fig.1 Positions of the measurement points inside the carpentry workshop

Fig.2 Images from the carpentry workshop

The following types of machines are working in the workshop: inclined circular saw CI 400, planing machine RG 800M, cutting machine MI 520, UMARO MNr 10 m and drilling machine.

Measurements were performed with the digital sound level meter Sper Scientific 840029 that was positioned at a distance of 1.2 m above the ground and with the microphone directed to the noise source. During the measurements the weighting scale A [dB(A)] was used and the entries were made with the Slow function, at every 10 seconds. The recorded values are represented by the diagrams in figures 3 to 7.

As expected, due to its location in the centre of the workshop and in the very vicinity of the working equipments, measurement point 5 had the highest values of recorded noise (figure 7). Also measurement point 1, placed very close to UMARO CI400 and also near the access door is characterized by a high level of noise (figure 3).

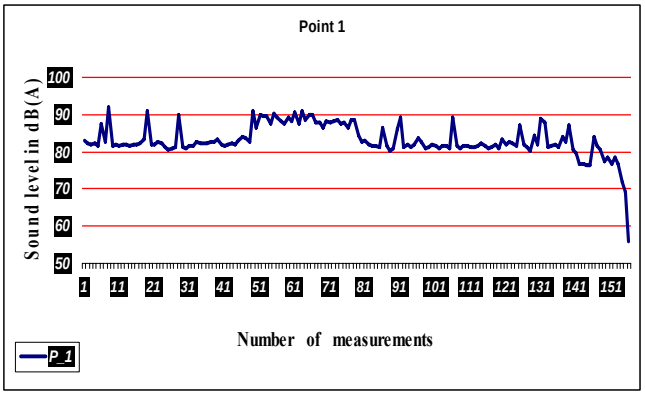

Fig.3 The measured values for point 1

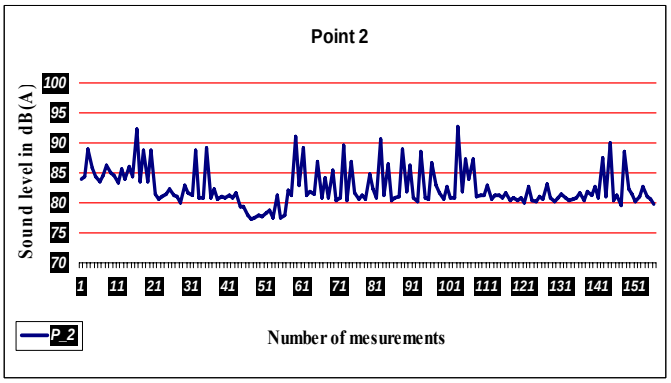

Fig.4 The measured values for point 2

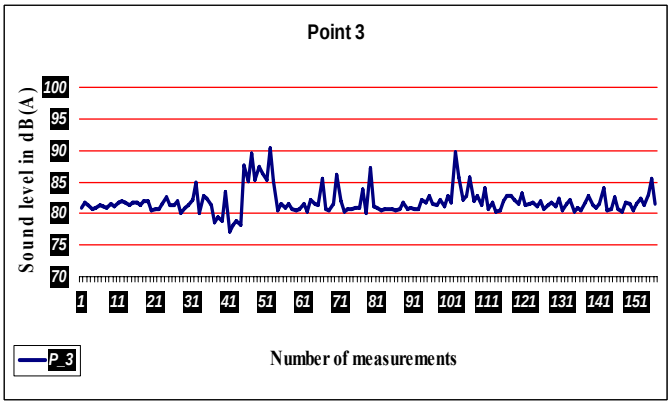

Fig.5 The measured values for point 3

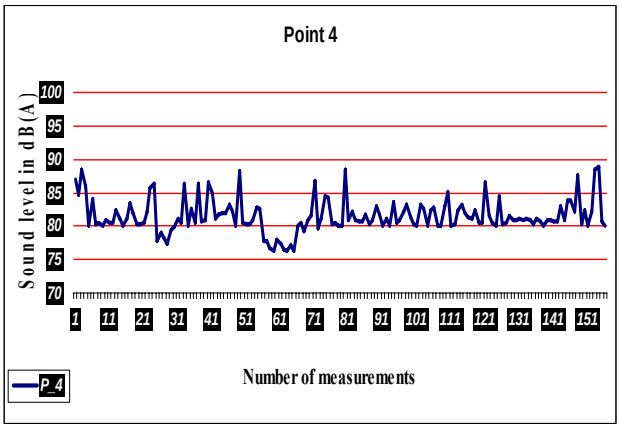

Fig.6 The measured values for point 4

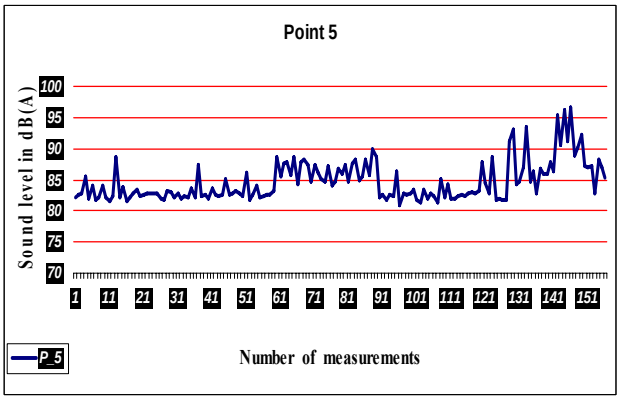

Fig.7 The measured values for point 5

3. NUMERICAL RESULTS

Recorded data were transferred into computer in order to process them by using Microsoft Excel. To describe and compare the sound levels that very over time, the equivalent continuous sound level has been calculated for each point, with the formula:

$$L_{eq} = 10\log\frac{1}{T}\left(t_1\times 10^{\frac{L_1}{10}} + t_2\times 10^{\frac{L_2}{10}} + t_3\times 10^{\frac{L_3}{10}} + ... + t_n\times 10^{\frac{L_n}{10}}\right) \quad (1)$$

where:
T – is the total period of time
L_i – are the measured sound pressure levels corresponding to the short periods of time t_i.

In Table 1 the values of L_{eq} for each measurement point and the time interval in which measurements were made are presented.

According to HG 493/12.04.2006, the limit value for noise exposure at the workplace is 87 dB(A) [6] and it is not exceeded in the carpentry workshop.

Table 1

Point of measure-ments	The time interval of measurements	Max. allowed dB(A)	Values of L_{eq} dB(A)	Obs.
1	08:24 – 08:50	87	84.96	Below the maximum allowed
2	09:09 – 09:35	87	83.94	Below the maximum allowed
3	09:36 – 10:02	87	82.50	Below the maximum allowed
4	11:07 – 11:33	87	82.35	Below the maximum allowed
5	11:34 – 12:00	87	86.29	Below the maximum allowed

4. CONCLUSIONS

The sound levels measured during the work in the carpentry workshop show that the noise inside the workshop rises up to levels that create discomfort for the workers.

Even if the maximum admitted values for workplace noise are not exceeded, L_{eq} in each measurement point is over 80 dB(A) - the lower exposure action value - meaning that the employer has to take measures to reduce the noise exposure of the workers, including the provision of individual noise protection equipment [6]. A more detailed study is needed in order to establish the conditions in which the exposure of workers exceeds 85 dB(A) - the upper exposure action value.

Data recorded inside the workshop can be used to obtain an overview of the noise environment of the workplace, but a better description can be give by modeling the noise map of the indoor area with specialized software.

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5. REFERENCES

[1] Crocker, M.I., Handbook of Noise and Vibration Control, John Wile, Hoboken, New Jersey, 2007, 1577 pp.

[2] Goelzer Berenice, Hansen, C.H., Sehrndt, G.A., Occupational exposure to noise evaluation, prevention and control, Federal Institute for Occupational Safety and Health, Dortmund, Germania, 2001, 336 pp.

[3] Hassall, J.R., Zaveri, K., Application of B&K Equipment to acoustic noise measurements, third ed., Danemarca, 1978.

[4] Kinsler, L.E., Frey, A.R., Coppens, A.B., Sanders, J.V., Fundamentals of Acoustics, John Wiley, New York, 2000, 567 pp.

[5] Rossing, T. D., Handbook of Acoustics, Springer Science + Business Media, New York, 2007 1182 pp.

[6] Hotarare nr. 493 din 12.04.2006 privind cerinţele minime de securitate şi sănatate referitoare la expunerea lucrătorilor la riscurile generate de zgomot, Monitorul Oficial, Partea I nr. 380 din 03/05/2006

[7] STAS 7150-72 Metode de măsurare a nivelului de zgomot în industrie

EVALUĂRI DE ZGOMOT ÎNTR-UN ATELIER DE TÂMPLĂRIE

Rezumat: *Această lucrare prezintă rezultate ale măsurătorilor efectuate pentru determinarea nivelului de zgomot din cadrul atelierului de tâmplărie al Universităţii Tehnice din Cluj Napoca. Măsurătorile au fost efectuate conform STAS 7150-72. Acest standard se referă la metodele de măsurare a nivelului de zgomot în mediul industrial. Datele au fost interpretate conform H.G.493 /12.04.2006 privind cerinţele minime de securitate şi sănatate referitoare la expunerea lucrătorilor la riscurile generate de zgomot.*

Ioana Alexandra MUSCĂ, PhD student, Technical University of Cluj-Napoca, Department of Mechanical Systems Engineering, 103-105 Muncii Blvd, 400641 Cluj-Napoca, ☎+40-264 401781, e-mail: sandy50113@yahoo.com

Diana Ioana POPESCU, Prof. dr. eng., Technical University of Cluj-Napoca, Department of Mechanical Systems Engineering, 103-105 Muncii Bvd, 400641 Cluj-Napoca, ☎ +40-264-401783, e-mail: Diana**.**Popescu@mep**.**utcluj**.**ro

Nicolae URSU-FISCHER, Prof. dr. eng. math. Technical University of Cluj-Napoca, Department of Mechanical Systems Engineering, 103-105 Muncii Blvd, 400641 Cluj-Napoca, ☎+40-264 401656, e-mail: nic_ursu@yahoo**.**com

Andrea VASS, Assist. Dr. Eng., Technical University of Cluj-Napoca, Department of Mechanical Systems Engineering, 103-105 Muncii Blvd, 400641 Cluj-Napoca, ☎+40-264-401781, e-mail: vass_andr@yahoo.com