Journal of Multidisciplinary Engineering Science and Technology (JMEST)
ISSN: 2458-9403
Vol. 6 Issue 11, November - 2019

Determination of Noise Level in Working with Milling Machine in Mechanical Workshops

Yusuf Dilay
Karamanoğlu Mehmetbey Uni. High School of Technical Sciences Karaman-TURKEY
ydilay@kmu.edu.tr

Adem Özkan
Karamanoğlu Mehmetbey Uni. High School of Technical Sciences Karaman-TURKEY
aozkan@kmu.edu.tr

***Abstract*—With the development of industry and technology in the world, the impact of noise in every aspect of our lives is increasing. In this context, the negative effects of noise on human beings increase day by day and it is thought that some measures can be taken to eliminate this. The source of noise that creates physiological and psychological effects in people's lives can be seen at every point of life. Noise not only in daily life, but also in business and professional life, many industrial sectors, industry and enterprises and so on. Is one of the most important factors that negatively affect human health in all areas of life?**

In this study, the noise levels that occur during the processing of metal material both at idle and at different speeds in milling machines used in machine and mechanical workshops were measured. Measurements were made at different points according to ISO 1996: 2003 with a handheld sound level meter supporting IEC 651 standard.

As a result of the study, the highest noise level during the processing of metal material in the machine was measured as 87.5 dB (A). This value of the machine at a speed of 720 rpm, 1 mm of material. It was measured during the metal removal process. The lowest noise level was measured at 63 dB (A) and 980 rpm when the machine was idle. In idle work, it can be said that the main source of noise originates from the drivetrain. Periodic maintenance of the drivetrain will reduce the noise level. In most of the trials, the noise level did not exceed 85.0 dB (A), which is critical for human health. However, if more than one workbench is used at the same time in the workshop, the use of protective earplugs is of great importance for human health.

Keywords—noise; human; health; milling; workshop

I. INTRODUCTION

This In parallel with the development of industry and the increase in mechanization, many health and safety risks have emerged in the world. All employees are exposed to risk factors that threaten their health and safety. One of the risk factors that employees are exposed to is noise. Due to the developing technology, the negative effects of noise in our lives are gradually increasing. The source of noise, which has physiological and psychological effects in people's lives, can be seen in almost every area. The effects of noise in the sectors are shaped according to the life styles of people or communities. This effect will deteriorate human health in all areas and bring with it permanent health problems.

Hearing loss, which is at the top of the risks faced by employees in the metal and manufacturing sector, is a form of illness that is included in the occupational diseases statistics lists of the Social Security Institution. In industrial life, people working in production, mining, metal, construction and manufacturing are exposed to noise. Hearing loss caused by noise in the world is among the most common occupational diseases. Employees may be exposed to different sound pressure levels at different time intervals while performing their duties [1]. “A weighted sound exposure” is used to assess the harmful effect of noise on a person [2].

In a workshop, mechanical workshops with 3 different materials; metal, wood, polypropylene (PP), made measurements of noise occurring in different processes. As a result of their studies, they reported that the highest noise level was measured with flex cutting of metal material with 105.4 dB (A), while the lowest noise level was measured with 67 dB (A) during processing of polypropylene (PP) material on CNC lathe [3].

Noise-induced, high volume continues to prolong the hair cells in the inner ear permanently damaged. This loud volume causes permanent hearing and deafness. The use of a very high weapon and exposure to instantaneous sounds such as explosion can cause sudden permanent hearing loss. Occasionally, this loud sound can destroy or perforate the eardrum. The harmful effects of noise may not be limited to the workplaces. For example, listening to music through headphones, overly noisy discos and clubs may also damage hearing in young people before joining the workforce [1], [4].

Noise first affects the hearing organ in humans. Acoustic injury or stroke may cause temporary threshold loss and permanent threshold loss. The initial effect is defined as hearing fatigue. As the intensity and intensity of the sound increases, it is possible to perceive a single sound as two separate sounds by increasing the hearing intensity.

The human ear hears sounds between 20-2000 Hertz. The frequencies below this are called ultrasonic sound and the frequency above it is called ultrasonic sound. Even if they are not heard by people, they may cause nausea, headache and restlessness. The most common infrasesier in the technology community is particularly effective. Airplanes, vehicles, houses that are open to traffic noise, the effect of these sounds are more [5].

Sound is a kind of energy and spreads in waves. To emit sound waves, particles must be present in the environment where the sound waves originate from the source. Therefore, sound waves can emit in solids, liquids and gases, ie in material environments. Since there are no particles or particles in the void, the vibration energy emitted by the sound source as a result of vibration cannot be carried and the sound is not propagated in the void. Sound waves are similar to water waves, but propagate in the form of invisible spherical waves, not circular waves that look like water waves. The unwanted sound is called noise. Continuous, noise is associated with loud sound that damages the hearing. Loud sound in entertainment venues may not always be perceived as noise, although it does affect human health 2015, p. 293).

In this study, both the idle operation and the noise levels occurring during the machining of metal materials were measured at different speeds in milling machines used in machine and mechanical workshops. Measurements were made according to ISO 1996: 2003 with a handheld sound level meter supporting the IEC 651 standard.

II. Materials and Methods

In this study, the noise levels occurred during the operation of the milling machine at the Machining Workshop of Karamanoğlu Mehmetbey University Vocational School of Technical Sciences were measured and the optimum working speed was determined in terms of occupational health and safety.

For noise level measurements, the CEM DT-8820 sound level meter was calibrated by the OMKA measurement center. The device used to measure the noise level is shown in Figure 1.

Fig. 1. *Device used for noise level measurements.*

In the experiments, the noise values that occurred during the machining of St 50 metal material were measured by idle operation of the milling machine. The measurement standard has been determined in accordance with TS EN ISO 9612: 2009. During the measurement, the microphone was held in the ear area of the machine staff, which was more exposed to noise and at a distance of 0.1 - 0.4 meters from the entrance of the outer ear canal. Some technical characteristics of sound level meter and milling machine used in the trials are given in Tables 1 and 2.

TABLE I. Some Technical Specifications of Sound Level Meter

Sound Range	Measurement	35 dB (A) – 100 dB (A)
Sound Accuracy	Measurement	±3,5 dB (94 dB level)
Audio Screen Resolution		0,1 dB
Dimensions		251 x 63,8 x 40 mm

TABLE II. Some technical features of the milling used in trials.

	Milling
Trade Mark	Falco
Power (kW)	4
Rotation per minute (d/d)	58-1800
Dimensions (lxwxh) (cm.)	191X203X190
Year built	2014

During the trials, the milling machine 388 rpm. Measurements were performed at operating speeds ranging from to 1800 rpm. In practice, when determining the working speed in the milling machine, the type of material being processed, quality of work, depth of work, etc. criteria. Considering this situation, the speeds used in the experiment were determined. Other speeds (58, 78, 108, 148, 208, 288 rpm), which are not preferred in practice or rarely used in different processes, are not used. During the trials, internal and external doors and windows of the workshop were kept closed considering the environmental factors. Thus, only the noise of the machine was tried to be measured. Other workbenches in the workshop were not operated. The measurement values were taken from different points of the milling machine operated in the trials. Each measurement was performed for approximately one minute, starting one time after the machine was started. The measured values are saved. The recorded measurement results were processed in computer environment.

III. Research Results

Table 3 shows the noise levels measured in the machining workshop with a milling machine. The noise level values of the milling machine both in idle and working with St 50 metal material were measured.

TABLE III. NOISE MEASUREMENTS ON UNIVERSAL MILLING MACHINE

Bench Position/ Rotation per minute (d/d)	Operating Condition of the Machine	Minimum Measured Noise Level dB (A)	Maximum Measured Noise Level dB (A)	Average Noise Level dB (A)
MC II 1800	Idle Working Metal Processing	67 73	80 85	71 76
MB II-1325	Idle Working Metal Processing	69 78	86 85	85 82
MA II-980	Idle Working Metal Processing	63 74	87 83	84 81
MC I-720	Idle Working Metal Processing	69 73	84 87	78 81
MB I-535	Idle Working Metal Processing	75,1 67	75,9 85	75,5 78
MA I-388	Idle Working Metal Processing	69 72	79 84	77 79,8

When Table 3 is examined, the noise level values measured during the machining of metal material in the milling machine were higher than those measured during idle operation. However, in many cycles this difference is negligible. The highest noise level of 980 rpm and 720 rpm was measured as 87 dB (A) in the processing of metal. The lowest noise level was measured at 63 dB (A) during idle operation of the machine at 980 rpm. No statistically significant difference was observed between the noises levels measured during the operation of the machine at different revolutions. The difference between the highest and the lowest noise level measured during idle operation of the machine was 12.1 dB (A). The difference between the highest and the lowest noise levels is 11.1 dB (A). The minimum noise level measured during idle operation of the machine is in the range of 63 to 75.1 dB (A), while the minimum noise level during processing of the metal material is in the range of 67 to 78 dB (A). The variation of the noise level values measured at idle operation of the machine at 535 rpm is very close. The reason for this can be said to be synchronized between the drivetrain. These values range from 75.1 to 75.9 dB (A).

Figures 2 and 3 shows a graphical representation of the measured noise level depending on the speed at which the machine is operated. The measured values used in the graph are the average noise level values measured for each speed

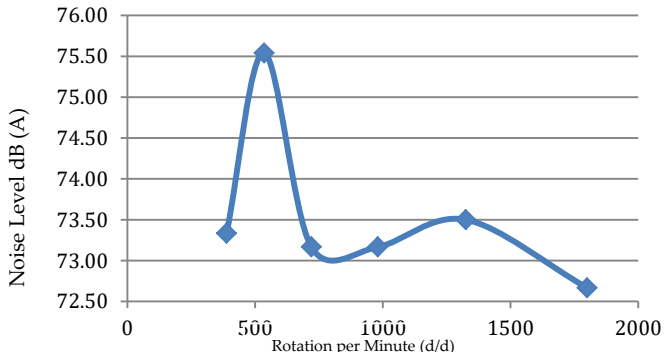

Fig. 2. *Measured noise level values during idle operation of Milling Machine.*

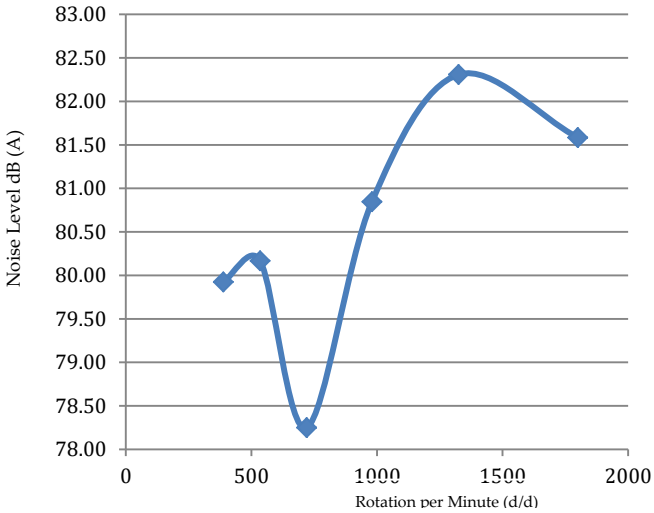

Fig. 3. *Measured noise level values during machining of metal material on milling machine.*

Figure 2 shows that the lowest noise level is measured at 720 rpm during idle operation and the highest noise level is measured at 535 rpm. The measurements show a radical increase in noise levels from 388 rpm to 535 rpm and a radical decrease from 535 rpm to 720 rpm. There has been an increase in the noise level when the speed of the machine is increased to more than 720 rpm. However, this increase was not as radical as in the range of 388-535 rpm. In the range of 1325 - 1800 rpm, the noise level gradually decreased. Thus, the lowest noise level was achieved at 1800 rpm. In this case, if the machine is maintained regularly, it can be said that 1800 rpm should be preferred if it is idle.

Referring to Figure 3, it is seen that the lowest noise level value is measured at 720 rpm while the highest noise level value is measured at 1325 rpm during the machining of metal material in the milling machine. The measurements showed a decrease in noise level from 535 rpm to 720 rpm and a linear increase from 720 rpm to 1325 rpm. In the range of 1325 - 1800 rpm, the noise level gradually decreased. The lowest noise level value was obtained at 720 rpm during the machining of metal material with milling machine. In this case, it can be said that it is appropriate for human health to prefer working speeds of 1800 rpm if the material and processing method are suitable for working with the machine. However, all noise values measured during operation of the machine were found to be below 85.0 dB (A). In the measurements made during the trials, it was observed that the time of the test was increased to 85 dB (A) from time to time. It was ignored with the idea that this would be caused by environmental factors or measurement errors.

Either way, the fact that the graph is not linear can be determined by the operator or by the depth of work, feed rate, and so on. It can be said to be caused by

factors such as. Setting the feed rate to the automatic machining position on the milling machine can reduce the noise level.

Result As a result of the measurements, during the idle operation of the milling machine in mechanical workshops, the noise levels are usually not at a level that negatively affects human health. However, it can be said that persons exposed to noise should use ear protectors or ear plugs with individual protection, as the noise level during the work with the bench sometimes exceeds the limit set by law. It is not known when and for how long the noise level will exceed the permissible upper limit of 85 dB (A). This is because the employees who are constantly present in the workshop environment may experience permanent health problems as they are exposed to high noise for a long time while using the bench.

In this study, measurements were made by operating only one milling machine in an environment with other machines. If it is considered that more than one machine can work at the same time, it is inevitable that they will be exposed to noise above the measured values. The fact that the traditional looms used in the workshops are old and not maintained on time, and the old and worn looms increase the noise levels. When these machines are compared with modern computer aided looms in terms of noise, it is clear that there will be lower noise values in the use of computer aided looms. With the widespread use of these benches, noise levels will decrease in mass production enterprises. Thus, the negative impact of the benches on human health will be reduced or completely eliminated. Considering that the measured noise levels are mainly due to both the idle and the processing of the metal part, a significant part of the noise generated by the transmission means of the machine is extremely important to eliminate the noise at the source. It can be said that this machine should be constructed with a more insulated insulation material.

In mechanical workshops, when sound levels exceeding 85 dB (A), which can affect human health, stimulus sound or light systems can be installed. Thus, with this stimulating system, employees can reach the source of the noise and intervene. This is extremely important both for its own health and for allowing longer use of the machine.

IV. RESOURCES

[1] Ozmen, A., Altiparmak, Z., Guests, B., Right, Ö., Uyar, R.E.Practical guidance on the protection of employees from noise-related risks, T.C. Ministry of Labor and Social Security General Directorate of Occupational Health and Safety, 2018, Ankara.

[2] Anonymous, TS 2607 ISO 1999 Acoustics - Determination of noise exposure in the workplace and estimation of hearing loss caused by this noise, 2005.

[3] Dilay, Y., Ozkan, A., Sabanci, K. Determination of Noise Level in Machine Shops. International III. KOP Regional Development Symposium Proceedings. p.293-296.22-24 October 2015, Aksaray.

[4]. Anonymous, From the Ministry of Labor and Social Security: Regulation on the Protection of Employees from Risks Related to Noise, 2013.

[5] Güler, Ç., Cobanoglu, Z. Noise. Ministry of Health. Basic Resource Series for Environmental Health no: 19 First edition, 1994, Ankara.