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BİR OTOMOTİV LABORATUVARI İÇİN GÜRÜLTÜ OPTİMİZASYONU ÇALIŞMASI

ÖZ

Otomotiv laboratuvarında uygulama yapılırken farklı motor tipleri çalışılmaktadır. Motorların çalıştırılması esnasında laboratuvar ortamında bulunan eğitimci ve öğrenciler birçok zararlı etkiye maruz kalmaktadır. Bu etkilerin en önemlilerden birisi gürültü kirliliğidir. Gürültü kirliliğinin insan sağlığı üzerine birçok etkisi bulunmaktadır. Ayrıca yönetmelikler gereği çalışma ortamlarında gürültü değerlerinin belirli bir seviyenin üzerine çıkmaması gerekmektedir. Gürültünün belirli değerlerin üstünde olması kişisel koruyucu donanım kullanılmasını gerektirmektedir. Bu çalışmada, otomotiv laboratuvarlarında bulunan farklı motorların, farklı yerleşim modellerinde gürültü değerleri tespit edilmiştir. Laboratuvar düzeninin minimum gürültü değeri oluşturacak şekilde tasarımı yapılmıştır.

Anahtar Kelimeler: Gürültü, Laboratuvar Tasarımı, Otomotiv

NOISE OPTIMIZATION STUDY FOR AN AUTOMOTIVE LABORATORY

ABSTRACT

In the automotive laboratory, different engine types are studied. During the operation of the engines, trainers and students in the laboratory are exposed to many harmful effects. One of the most important of these effects is noise pollution. Noise pollution has many effects on human health. Moreover, in accordance with regulations, noise values should not exceed a certain level in working environments. The fact that the noise is above certain values requires the use of personal protective equipment. In this study, noise values were determined in different models of different engines in automotive laboratories. The design of the laboratory is designed to create a minimum noise value.

Keywords: Noise, Laboratory Design, Automotive

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1. INTRODUCTION

Sound waves are longitudinal waves emitted in solid, liquid or gaseous media. The waves are formed by any mechanism based on vibrating the media surrounding the wave source. The simplest sound waves are sinusoidal waves, which have a certain frequency, amplitude, wavelengths, and progress through an environment of compression - expansion. As the sound waves move through a medium, there is a change in the pressure of the molecules in the environment as well as a change in pressure. It is more appropriate to show the sound waves in the physics by changing the pressure because the human ear is sensitive to pressure changes. The sound frequency spectrum of the human ear extends from 16 Hz to 20 kHz. Noise is generally defined as unwanted and disturbing sound. Noise is often undesirable sounds that are artificially occurring, whose quality and quantity are impaired. As can be understood from the definition, the notion of undesirability suggests that the subjectivity of the noise can vary from person to person, so the effects on the psychological and neuro-reception system can be perceived by people as different responses. The most important effect of noise, which does not differ significantly from person to person, is its effect on hearing. The most important effect of noise in terms of working is that it causes hearing loss. Above a certain volume, the inner ear is affected and the hearing state starts from the treble. In hearing loss, the severity of the noise and the duration of exposure are very important. The distortion of the sound is one of many different waves of sound. In a more technical definition, noise is the superposition of sound waves. In other words, when the frequency spectrum of the noise is considered, it is known that there are many frequencies. The deterioration of the quantity of the sound, however qualified and no matter how qualified the sound of the human body is a harmful value to reach. For example, if you like the sound of a very beautiful music that exceeds 90 dB (A), it will cause hearing loss. Of course, this effect of noise is the most easily seen effect. The effects of psychological and neuro-reception system may begin even in lower intensity sounds. However, it should also be emphasized that such effects are effects that vary from person to person (Utku, 2006; www.cevrekoruma.ibb.gov.tr) For industrialists and the public, it is a requirement to reduce the negative effects of noise and reduce to the level that will not harm human health and to develop noise control methods for this purpose (Özbay ve Kavaklı,2008).Table 1 summarizes the effects of noise on people in general.

Table 1. The effects of noise on people (Feldman ve Grimes,1985)

Psychological effects such as behavioral disorders, irritation, boredom, weakness,
Changes in body activity; increase in blood pressure, circulatory disorders, acceleration in respiration, rhythm disorder in heartbeat, physiological effects such as sudden reflexes,
Physical effects, such as temporary and permanent hearing damage,
Performance effects such as decrease in efficiency, concentration disturbance, inhibition of movements

Measures can be taken for the noise in the working environment and the effects on the health of the personnel can be reduced. In developed countries, specific standards have been set for noise in the working environment. In Turkey, certain measures can be taken in the workplaces under the Occupational Health and Safety Law No. 6331 dated 20/6/2012. This Regulation; According to Article 30 of the Law No. 6331 and the Law on Organization and Duties of the Ministry of Labor and Social Security No. 3146 dated 9/1/1985 and in accordance with the European Parliament and Council Directive 2003/10 / EC of 6/2/2003 (TBMM,2012). The purpose of this regulation is; to determine the minimum requirements for protection against health and safety risks, in particular hearing-related risks, which may occur as a result of exposure of employees to noise.

In order to reduce the effects of noise, it is necessary to focus on three points (Beranek,1983; Kroemer,2000; Şahin,2003;Tayyari,2001; Brüel,1982):

1. To control the noise at the source: It is the most effective way to control the noise at the source. The noise source can be controlled or minimized by applications such as performing machine maintenan-ce, installing a a sound absorber, changing the location of the source.
2. Controlling the noise between the source and receiver: Adjusting the distance of the machines to each other, placing sound absorbing materials on the surfaces of the working environment, structurally sound breaking barrier and wall applications are among the effective methods.
3. Control of noise in the receiver: If the sound cannot be reduced in the source and in the environment; protective measures can be applied to people who are exposed to noise, for example by isolating the person exposed to the noise, reducing the time for exposure to noise, working with rotation in noisy places or using personal ear protectors
4. Control of noise at the receiver; it should be the last met-hod to be applied, as it can affect the working comfort of the receiver.

People can be exposed to constant noise in their education as well as their working lives. There are many noise sources such as drills, compressors, grinding and pneumatic spray guns in the application laboratories of vocatio-nal high schools and vocational colleges which form the basis of this study. But the biggest source of noise is the noise generated by internal combustion engines.

Therefore; school laboratories should comply with noise regulations. Studies should be done to reduce noise and prevent the students from damaging the instructor- students in the environment.
In this study; measurements from noise sources were taken in a sample automotive laboratory and the planning was proposed to reduce the effects of noise. In the measurements, the noise generated by two different types of en-gine and the ventilation system have been emphasized.

2. MATERIALS AND METHODS

In the measurements, the engine with a motor volume of 1581 cm3, the only muffler in the exhaust system and the 2000 cm3 diesel engine seen in Figure 2 have been used. The engines have been located on the coffee table. The measurements were carried out in a workshop environment of 22.5 ° C. Data was recorded after the engine was bro-ught to operating temperature.

The noise generated by the engine was measured using the CEM DT-8820 sound level meter. The device was calibrated by the OMKA calibration center and the values were determined as decibel [dB (A)]. As the measurements recorded from the working distance were made in the closed area, the noise source wasonly the engine and ventilation system. This ventilation system, as shown in Figure 4, has used to remove the exhaust gases from the engines from the laboratory.

Figure 1. Gasoline test engine

Figure 2. Diesel test engine

Figure 3.Sound levelmeter

Figure 4. Ventilation system

3. RESULTS AND DISCUSSION

Figure 5 shows the location of the laboratory's layout and measurements. Measurements were made for the different motor type at the same point. Figure 6 shows the measurement values in two motors. Different positioning and different speeds have been used in the measurements. Two sound sources (engine + ventilation system) produce sound. The sound level of the ventilation system was 70 dB(A). For gasoline engines, the lowest noise measurement at 1000 rpm was 84.4 dB (A) in test 7; the highest measurement was determined in the test 5 with 87.5 dB(A). The lowest noise measurement at 3500 rpm was 97.4 dB(A) in test 3. the highest measurement was made in test 7 with 98.9 dB(A). The lowest noise measurement at 1000 rpm in diesel engine was 86.2 dB(A) with test 8; the highest measurement was 90.5 dB(A) with test 6. The lowest noise measurement at 3500 rpm was found in test 8 with 100.2 dB(A) and the highest measurement was in test 6 with 101.4 dB(A).

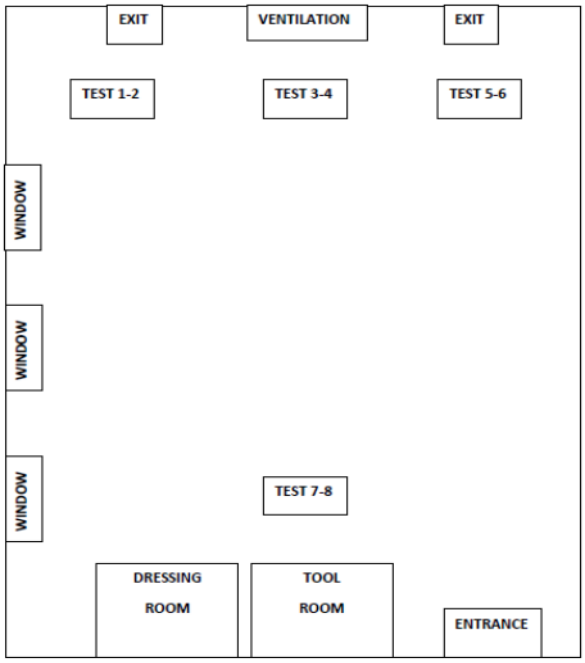

Figure 5. Laboratory sketch (12.5 x 14 m) and test points

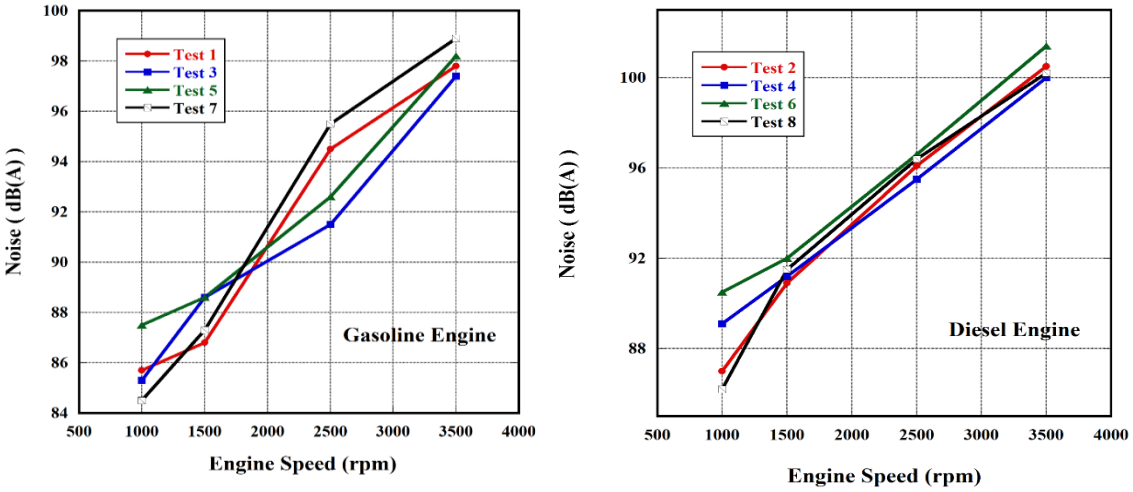

Figure 6. Results of the measurement for gasoline and diesel engines

The sum of the noise values for gasoline engines and diesel engines is given in Figure 7. For Test 3, a total of 362.8 dB (A) was calculated. For test 8, the sum was calculated as 374.3 dB(A). Measurements were found to be higher than 80 dB(A) in all tests.

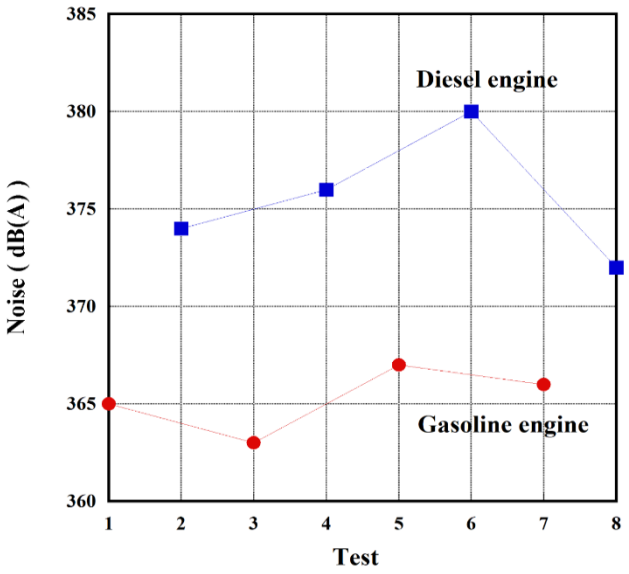

Figure 7. The sum of noise for all test

4. CONCLUSION

When the test results are evaluated; the optimum noise values for the diesel engine are in test 8. For the gasoline engine the test 3 is the most optimum noise value.
In the tests, the sound level of the walls was increased. The reason for this situation is seen as the reflection of the noise coming from the sound source from the walls.
When all data are evaluated; In the laboratory design, it is understood that the motors should be positioned in the middle.

In addition, test 3 and test 4 measurements; the proximity of the motors to the ventilation system, which is another sound source, should also be evaluated.
The noise value during the operation of the engines exceeding 80 dB (A) requires the use of personal protective equipment for students and trainers. Otherwise, prolonged exposure to high noise; it causes hearing loss and reduces working comfort.

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