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NOISE BARRIER AT WELDING WORKPLACE

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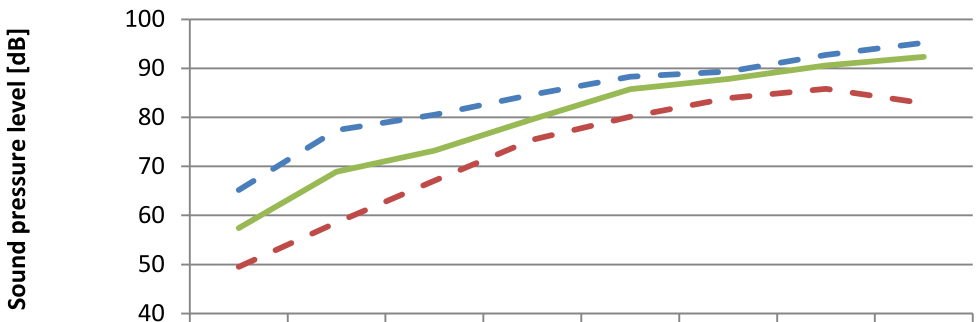
Noise barriers in the workplace are one of the solutions to seclude the workplace from the remaining part of the industrial hall. They are used both to reduce noise coming from the work as well as the separation of the workplace of a high level of background noise. In the case of welding work in the current practice used acoustic screens replacements welding in order to limit the noise propagation. However, we should consider the possibility of using sound-absorbing screens, which also allow for reduction of noise at a workplace. This paper focuses on the ability to assess performance sound insulation and sound absorption using in-situ methods. For the two kinds of noise barriers, measurements were made for check the possibility of using impulse measurement method for the evaluation of these parameters in place of use of the screens and relate them to the indicators designated in laboratory conditions.

Keywords:

1. Introduction

Noise at working place is a well-recognized issue. Methods of measuring and assessing the impact of noise per worker are defined in relevant standards and regulations [1,2,3]. Often, the problem occurs at the moment of selecting the appropriate method to protect the worker from the threat.

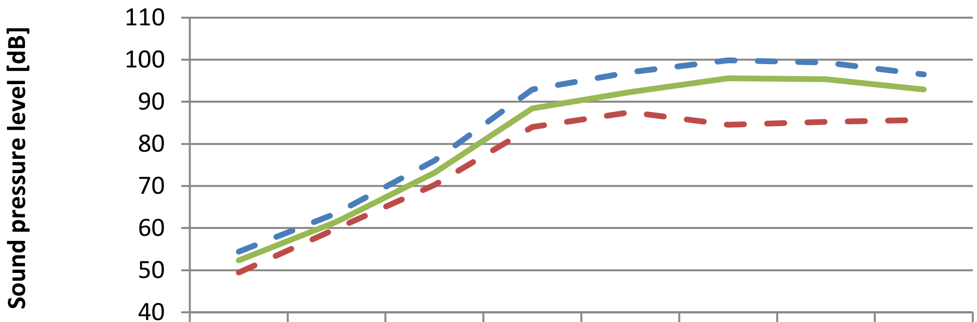
The article presents the method of protection against noise in the welding place. It performs some very loud operations such as welding, hammering and grinding with a hand grinder. The position of the welder often poses a danger not only to this worker, but to the workplace, ie the noise at manual welding. The characteristic of noise generated during manual welding (Fig. 1), grinding (Fig. 2) and hammering (Fig. 3) on the basis of measurements are presented on the charts below.



	63	125	250	500	1000	2000	4000	8000
max	65,2	77,4	80,5	84,6	88,3	89,3	92,7	95,2
min	49,5	58,5	67,1	75,4	80,1	83,9	85,8	82,9
average	57,4	68,9	73,2	79,6	85,7	87,8	90,6	92,3

Frequency in octave bands [Hz]

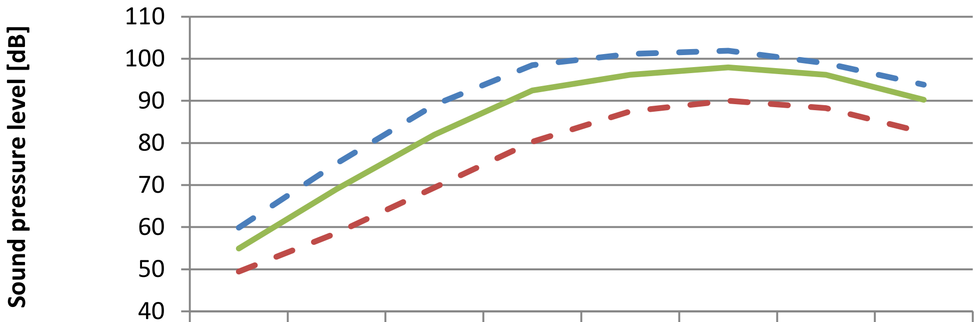
Figure 1: Noise spectrum of welding – basis on own measurement



	63	125	250	500	1000	2000	4000	8000
max	54,4	63,5	76	92,9	97	99,8	99,3	96,5
min	49,4	59,9	70,2	84	87,5	84,5	85,2	85,7
average	52,3	61,5	73,1	88,4	92,3	95,6	95,4	92,9

Frequency in octave bands [Hz]

Figure 2: Noise spectrum of grinding – basis on own measurement



	63	125	250	500	1000	2000	4000	8000
max	59,9	75,1	89	98,5	101,1	101,9	98,9	93,8
min	49,4	58,6	69,4	80,3	87,5	90	88,3	82,5
average	54,9	69,0	82,0	92,5	96,2	97,9	96,2	90,2

Frequency in octave bands [Hz]

Figure 3: Noise spectrum of hammering – basis on own measurement

The main problem that occurs when trying to protect a worker from the negative impact of the operation is that the worker locates his head near the source of the sound, which significantly reduces the potential for noise reduction.

In such cases, accent is placed primarily on limiting the spread of noise to other posts, which, in combination with safety requirements (e.g. fire risk), significantly limits the possibilities.

The presented results of the study take into account the additional aspect of such safeguards, i.e. the issue of not only limiting noise outside the work area, but also the aspect of the secondary impact, ie the reflection of generated noise from the partitions / welding screens.

2. Measurements

The research was carried out using examples of prototype solutions made at KFB Polska Sp. z o.o. These are acoustic screens adapted for welding stations as an alternative to standard acoustic screens used in industrial halls made with using Cellofoam® materials (Fig. 4) and sound absorbing panels made of perforated steel with mineral wool core secured with an additional fiberglass sheath (Fig. 5). The pictures below show an overview of the screens.

Figure 4: Photo of prototype welding screen by KFB

Figure 5: Photo of prototype noise barrier made of acoustic panels by KFB

The first solution is characterized by high mobility, which makes it easier to use in situations where it is necessary to provide easy modification of the working space.

The second solution is more acoustically efficient, but its disadvantage is the lack of mobility - it is a standard fixed screen inside the hall, meeting the fire safety requirements.

The measurement was carried out using the method of impulse response to determine the sound Reflection Index [RI] and Sound Insulation index [SI] in "in situ" conditions.

The size of a sample of welding screen was 2mx2m (two partitions) and size of 2,5m x3m for acoustic barrier with mineral wool core.

The sketch of the set-up for both methods shown on the pictures below (Fig. 6, Fig. 7).

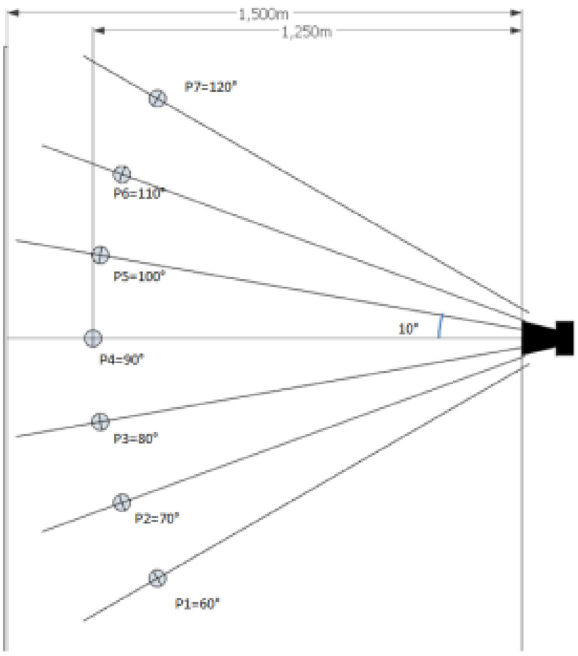


Figure 6: The sketch of position for loudspeaker and positions of microphone for RI measurements

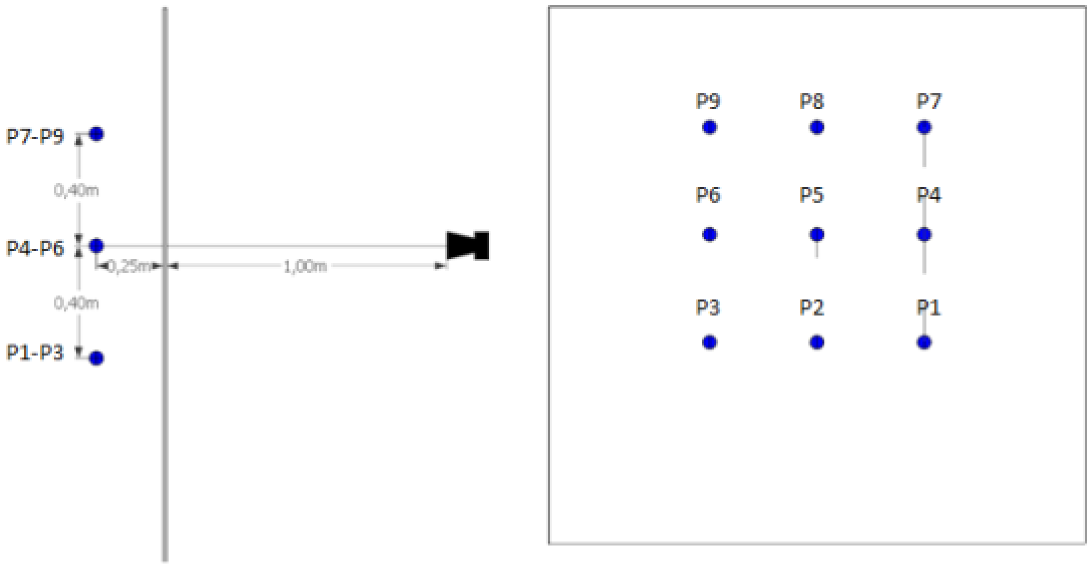
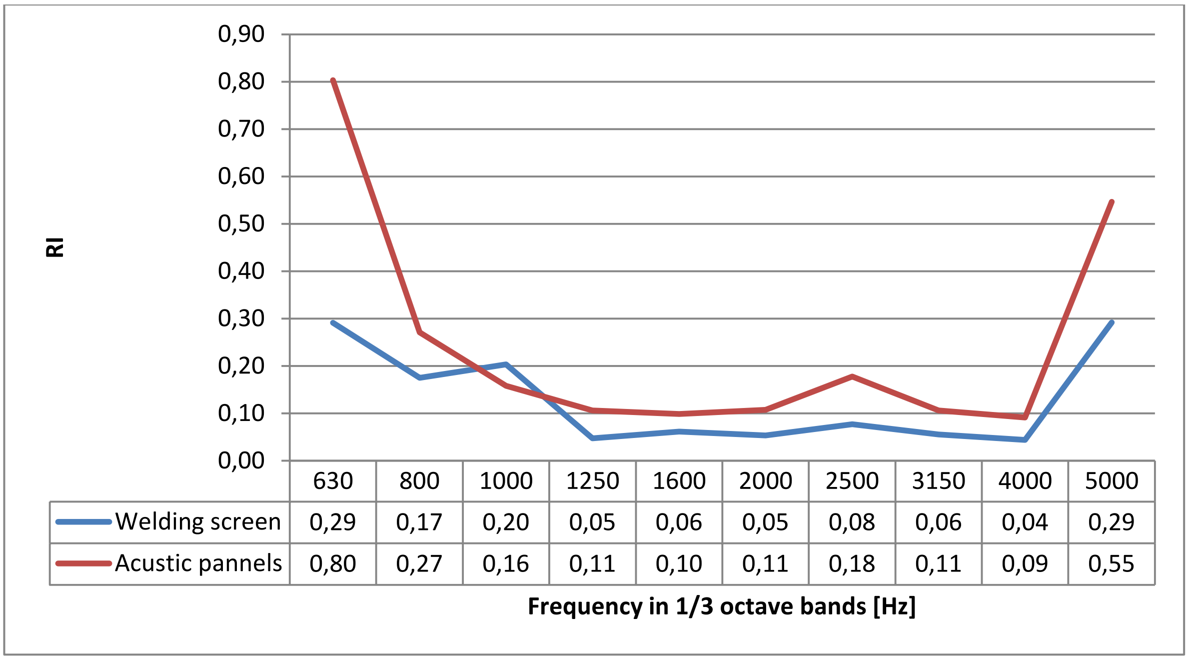


Figure 7: The sketch of position for loudspeaker and positions of microphone for SI measurements

3. Results

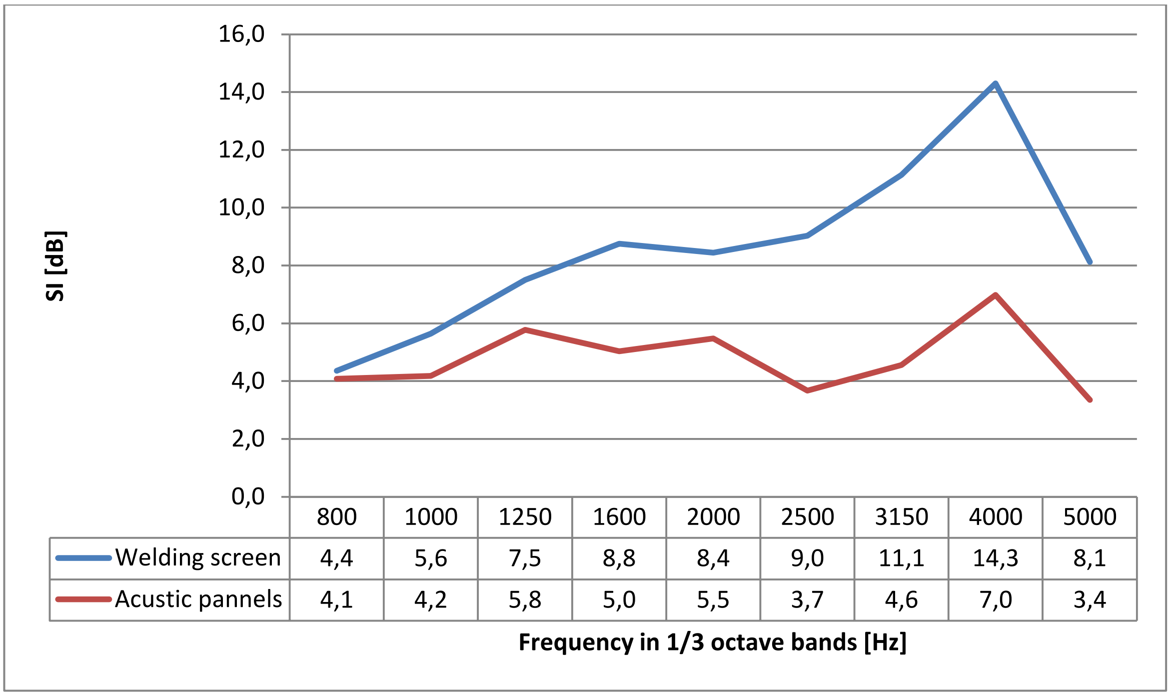
Taking into account the height of the acoustic screens and the impact of the reflecting surfaces of the substrate, using the indications presented in [4], the range of measurement frequencies was limited from 630 Hz.

The following chart (Fig. 8, Fig. 9) compares the results obtained in terms of Reflection Index RI [dB] and Sound Insulation factor SI [dB] for the tested screens.



	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Welding screen	0,29	0,17	0,20	0,05	0,06	0,05	0,08	0,06	0,04	0,29
Acustic pannels	0,80	0,27	0,16	0,11	0,10	0,11	0,18	0,11	0,09	0,55

Figure 8: Reflection Index RI in 1/3 octave bands for tested screens



	800	1000	1250	1600	2000	2500	3150	4000	5000
Welding screen	4,4	5,6	7,5	8,8	8,4	9,0	11,1	14,3	8,1
Acustic pannels	4,1	4,2	5,8	5,0	5,5	3,7	4,6	7,0	3,4

Figure 9: Sound Insulation [dB] in 1/3 octave bands for tested screens

Analysing the results of measurements it can be stated that the acoustic panels have a lower sound insulation (Fig. 9) and a higher reflection index (Fig. 8) than the tested welding screens. This is due to the fact that the KFB panel is double-sided perforated therefore the main insulation element is mineral wool core having a porous structure. The higher reflectivity is due to the stiffness of the structure. The results indicate that parametrically welding screens are better, although their main advantage, mobility, is also related to their main disadvantage. Due to the need to maintain the mobility of the screen its dimensions in particular the altitude are greatly reduced. Despite better acoustic properties, much of the final effect is lost through a reduced propagation path around the screen.

4. Conclusions

The conducted research is an extension of the issues undertaken in the framework of our own work [8] on the possibility of using in situ methods described in ENV 1793-5 [4] for screens and building elements indoors.

The results show the difference between the values obtained for the welding screen and the acoustic panel manufactured by KFB Polska Sp. z o.o. The obtained parameters make it possible to conclude that a better material is the welding screen, but it is important to keep in mind its limitations as to the possible size while maintaining its mobility.

Comparing the noise values measured with welding, grinding and hammering (Fig. 1 – Fig. 3) with the Reflection Index values (Fig. 8), it is further stated that this solution is also better and more practical for the welder's workplace. Lower reflectance values allow us to say that, although the main source of noise is the direct work of the worker, the use of this type of screen will limit the worker's secondary exposure to the sound reflected from the screen limiting his position

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