REVIEW OF NECESSARY RISK ASSESSMENT EQUIPMENT FOR PREVENTION OF HAND-ARM VIBRATION SYNDROME

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Introduction

The EU Directive 2002/44/EC[1] of the Physical Agent Directive (Vibration) defined three things to employers. For preventing hand-arm vibration syndrome (HAVS) among workers, employers must take the following measures: ① choose appropriate working equipment producing the least possible vibration, ②assess probable magnitude of the vibration, based on the daily exposure value normalized to an eight-hour reference period A(8), and ③if possible, measure the levels of mechanical vibration to which workers are exposed at the worksite, to assess whether the health and safety risk of each worker is ensured. For preventing HAVS, the A (8) is considering the introduction of risk assessment as following steps.

Procedure 1: Understanding the vibration total value of frequency-weighted r.m.s. acceleration of the individual tool risk

Employers must monitor the hazards of the vibration from the usage of the vibration tool in the workplace and specify the hazards (the vibration total value of frequency-weighted r.m.s. acceleration of the individual tool) of vibration tool according to Test Protocols or Field measurement.

Procedure 2: Calculation of Daily Personal Vibration Exposure (A(8))

Employers must calculate the A(8) from the vibration total value of frequency-weighted r.m.s. acceleration from Procedure 1 and the Daily Vibration Exposure Times.

Procedure 3: Evaluating the necessity of a Vibration reduction plan according to the Daily Vibration Exposure A(8)

① In cases when A (8)>5.0 (Above the exposure limit value)
Take immediate action to bring exposure below the exposure limit value. In addition, management should implement controls on vibration exposure times and increase the utilization of low vibration tools.

②In cases of 2.5 < A (8)≦ 5.0 (Above the exposure action value, but the exposure limit value is not exceeded)
Implement a program of measures to reduce exposure and risks to a minimum. In addition, management should implement controls on vibration exposure times and increase the utilization of low vibration tools.

Procedure 4: Design and implementation of concrete vibration reduction plans according to Daily Vibration Exposure A(8)

According to the EU Directive, the manufacturers must declare the magnitude (DEV) of the individual tool according to the test protocols or to the field measurements (a_{hv}) for preventing the HAVS in the workplace defined in European Standard ISO 5349-1[2] and the detailed practical guidance on using the method for measurement of vibration at the

workplace is given ISO 5349-2[3]. The risk assessment control of EU Directive 2002/44/EC[1] is considering using the DEV or a_{hv} on the tool handle vibration. When this directive is considering the health and safety risk prevention of each worker, this directive is using the DEV or a_{hv} for the vibration risk assessment. At current stage, these considerations are demonstrating the limitations around the world. Therefore, this paper is to clarify the limitations and the solution consideration whether this risk assessment can apply to each worker.

Limitation and Solution

Rimell et al[4] demonstrated the huge differences between DEV and a_{hv}. Also, this risk assessment is using the average vibration magnitude (a_{hv}) for evaluating the risk to each worker. During real tool work in the worksite, each worker's tool vibration magnitude measured by ISO5349-1[2] standard is having huge difference between each worker even though the using tool is the same. Therefore, the ISO working group is considering the application of Personal Vibration Exposure Meter (PVEM) for each worker's risk assessment. This PVEM seeks to follow measurement guidance within the ISO5349-1[2] standard for preventing HAVS. Within clause 4.3 of this standard, it is stated that the characterization of the vibration exposure is assessed from the acceleration of the surface in contact with the hand as the primary quantity. Therefore, ISO 5349-1[2] is assuming that the hand-transmitted vibration exposure magnitude is the tool handle vibration measurement, although the hand-transmitted vibration is affecting to each worker by the many factors of Annex D of ISO 5349-1[2] standard. This PVEM measurement value might be automatically including the many factors of Annex D of ISO 5349-1[2]. Taylor at al[4] investigated the relationship between vibration magnitude of a hand-held electric drill with different operating postures. The experiment included determination of participants temporary threshold shift (TTS) of vibrotactile perception threshold (VPT) at the tip of the index finger. The research concludes that tool handle vibration measurement, in accordance with ISO 5349-1[2], does not properly assess the potential hazard from authentic workplace tool usage conditions of varying postures. These results indicate that there is scope for development of a suite of new evaluation methods or potential for innovative equipment which may provide a more realistic and practical assessment of HTV exposure. The equipment idea will be presented at the 8th ACHV by the authors.

References

[1] Directive 2002/44/EC of the European parliament and of the Council of 25 June 2002 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration) (sixteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).
[2] International Organization for Standardization (ISO) (2001) Mechanical vibration — measurement and evaluation of human exposure to hand-transmitted vibration, part 1: general requirements. ISO 5349–1. ISO, Geneva.
[3] International Organization for Standardization (ISO) (2001) Mechanical Vibration – Guidelines for the Measurement and Assessment of Human Exposure to Hand-transmitted Vibration. Part – 2: Practical Guidance for Measurement at the Workplace. ISO 5349–2. ISO, Geneva.
[4] Taylor, M., Maeda, S., Miyashita, K. (2021). An Investigation of the Effects of Drill Operator Posture on Vibration Exposure and Temporary Threshold Shift of Vibrotactile Perception Threshold. MDPI Vibration. 395-405. 2021-MDPI-Vibration-04-00025.pdf