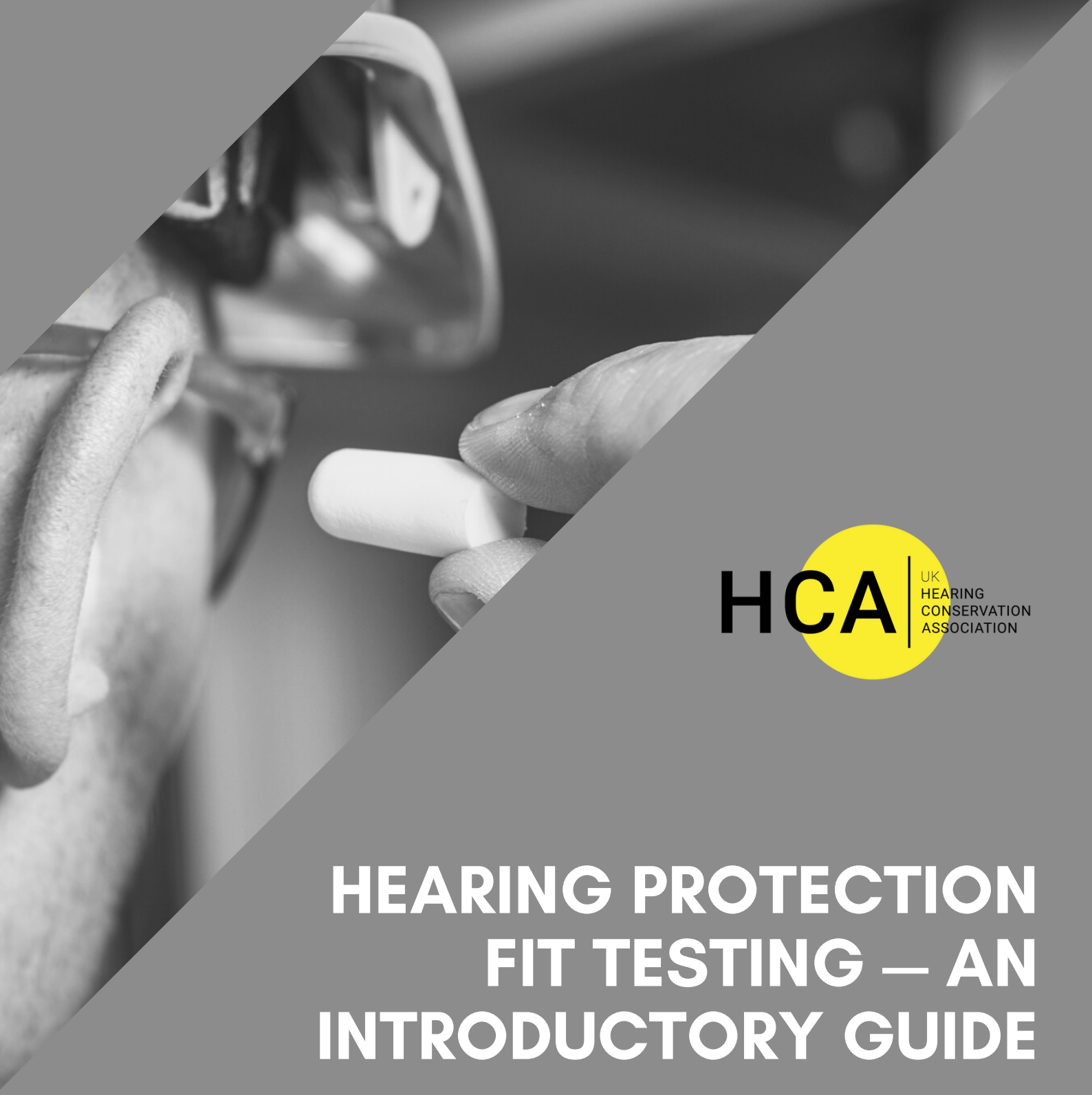

HCA | UK HEARING CONSERVATION ASSOCIATION

HEARING PROTECTION FIT TESTING — AN INTRODUCTORY GUIDE

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GENERAL FOREWORD

This document presents an Introductory Guide by the United Kingdom Hearing Conservation Association (UKHCA). This Introductory Guide represents to the best knowledge of the authors, their employers and UKHCA, the evidence-base and consensus on good practice, given the stated scope of the document and at the time of publication.

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INTRODUCTION

The best way to ensure hearing conservation is through elimination and control of noise at source. However, where all reasonable control measures have been implemented and exposures are still likely to exceed 85 dB averaged over the working day, provision and use of hearing protection becomes mandatory under The Control of Noise at Work Regulations (2005). Hearing protection is a commonly used control measure and is heavily relied upon as the last line of defence against harmful levels of noise exposure in many workplaces.

SELECTING HEARING PROTECTION

Hearing protection devices (HPD) fall into two broad categories: earmuffs and earplugs. Any HPD must be both adequate and suitable to ensure the wearer is protected. This means:

- Adequate – It is right for the hazard and reduces exposure to the level required to protect the wearer's health.
- Suitable – It is right for the wearer, task and environment, such that the wearer can work freely and without additional risk.

To select hearing protectors that will protect the wearer, you will need a basic understanding of:

- the noise hazard; including intensity, frequency and whether containing impulsive noise
- the type of work being carried out and the environment;
- any specific wearer requirements, such as other Personal Protective Equipment (PPE)

The choice of hearing protection in relation to workplace noise exposure levels is usually selected based on manufacturers' data on the 'attenuation' or protective values that the specific hearing protector can afford the wearer. This choice aims to bring the exposure level down to below 80 dB, where the risk to hearing can be prevented or reduced. Comfort and fit are also significant factors in hearing protection selection and can often be deciding factors alongside attenuation.

MANUFACTURERS' DATA

Manufacturers of hearing protection products are legally obliged to provide information with their products to indicate the potential protection each device can achieve. These are usually reported on product packaging or user information as a Single Number Rating (SNR), High, Medium, Low (HML) values and Assumed Protection Values (APV) which are derived from laboratory testing under controlled conditions. Studies have shown, however, that real-life performance is often much lower than the specified performance rating, which can mean a user is put at risk of hearing and other auditory health damage (HSE, 2009).

The SNR is commonly mistaken as representing the real-world performance of a hearing protection device without accounting for the individual and environmental factors that affect it.

In many instances, poor performance of hearing protection devices is caused by;

- poor fitting technique
- removal for periods of time during the working day and
- incompatibility or interferences of seal and fit due to other PPE or workwear.

Employers often select hearing protection devices for their highest attenuation properties thinking that 'more is better', leading to overprotection. This can result in decreased audibility of important communication and emergency sounds such as fire alarms or moving vehicles, putting workers at risk of accidents and injury.

FIT TESTING

When selected as a control measure, hearing protector performance is critical to help ensure individual protection where it is relied on within the context of hearing conservation programmes. There has been an emergence of commercially available systems that offer the capability of individually fit testing hearing protectors to assess how much attenuation an individual user is receiving based on the type of hearing protector, fitting technique and worker motivation. Hearing protection fit test systems either calculate a Personal Attenuation Rating (PAR) which is an estimation of the noise reduction obtained across test frequencies in one or both ears expressed as a single number or show a simple pass/fail without full attenuation characteristics. The time involved in conducting a fit test session with different systems ranges from a few minutes to up to 20 minutes, depending on the test method employed.

Individual fit testing plays an important part in helping to educate workers and address issues of comfort, fit and achieving appropriate protection from hearing protection. Fit testing highlights the importance of actual protection achieved by a hearing protection device fitted by the user in the workplace setting and helps identify training needs.

TYPES OF FIT TESTING

Current types of hearing protection fit test methods available in the UK are explained below, with a summary of the pros and cons associated with each.

1 OBJECTIVE: FIELD MICROPHONE IN REAL EAR (FMIRE)

This test method simultaneously measures the sound pressure level outside and inside a hearing protection device. Being an objective test method, no input response is required from the test subject and the data generated as Personal Attenuation Rating (PAR) reflects the type of hearing protector and/or size (if applicable) as well as fitting technique. The PAR value can help determine adequacy of the chosen hearing protector for the given workplace environment.

This method is quick and reliable but requires specialist equipment. Some FMIRE systems also require a trained operator and some versions are only compatible with a specific manufacturer/product.

2 SUBJECTIVE: AUDIOMETRIC OR AUDIOMETRIC BASED SYSTEMS

These tests measure the change in a worker's hearing threshold level at various frequencies using headphones that deliver sound to the user's ear with and without protection. It relies on the individual users to respond to the quietest sound they can hear. The data is collected, stored and used to calculate a Personal Attenuation Rating (PAR) which can be used to determine the adequacy of the protection.

This method is slower than method 1 but can be conducted using audiometric testing equipment and specialist headphones. This method can be used to test all types of earplugs. The method requires a quiet test environment such as a sound booth or noise-attenuating headphones to conduct the test.

3 SUBJECTIVE: WEB-BASED PERSONAL ATTENUATION RATING SYSTEMS

These tests measure the difference in sound level between sound outside and inside the hearing protection, using headphones that deliver sound to the user's ear with and without protection. It relies on the individual users to respond to the quietest sound they can hear. The data is collected, stored and used to calculate a Personal Attenuation Rating (PAR) which can be used to determine the adequacy of the protection.

This method is slower than method 1 but no specialist equipment or trained operator is required and tends not to have any product compatibility issues. This method can be used to test all types of earplugs.

4 SUBJECTIVE LOUDNESS BALANCE TEST

The test subject is asked to balance the loudness of sound sources provided between the ears with one or two earplugs and without any earplug in a subjective measurement. The data is stored and used to calculate a Personal Attenuation Rating(PAR) which can be used to determine the adequacy of the protection.

As with method 2 this is slower than method 1, relies on an accurate response from the test subject (listener) and any significant asymmetry in hearing loss and/or hearing loss greater than approximately 40-50 dB makes loudness balance testing impossible.

5 ACOUSTIC SEAL TESTS BY 'APPS'

These tests explore the integrity of the acoustic seal of the hearing protection by means of a mobile device application ('app'). No input or response is required from the test subject and the data is used to issue a pass/fail result or a Personal Attenuation Rating (PAR).

Specialist equipment is required, it is quick, and with some products it is possible to store records.

6 ACOUSTIC SEAL TESTS BY PRESSURE

These tests check the integrity of the acoustic seal of the hearing protection based on air pressure decay over time. No input or response is required from the test subject and the data is used to issue a pass/fail result. This test is commonly used for checking custom-moulded earplugs.

Specialist equipment is required, it is quick, but no records are stored. There is no correlation between pressure decay and attenuation characteristics of the tested hearing protector.

CHOICE OF FIT TEST SYSTEM

Choice of the most appropriate fit test system will be based on the level of risk, workplace environment (which should be reasonably quiet for subjective tests), number of workers, current hearing protection and compatibility with the test. In addition, reported measurement uncertainty may also play a key factor in the selection process to assess reliability and confidence in the test data.

The UKHCA suggests that employers consider systems which can calculate a PAR for each individual user and systems that allow a record of the test to be made and stored in order to monitor fit testing performance, target training, or explore alternative protection measures or devices, check compatibility with other PPE (where appropriate) and demonstrate ongoing protection of the workforce.

BENEFITS OF A FIT TESTING PROGRAMME

Fit testing can benefit a hearing conservation approach in a number of ways:

1. Improving the likelihood that a hearing protection device can actually protect the wearer and is appropriate for their needs.
2. Providing insights and allowing a more targeted approach to training and information provision on how to select, use and care for hearing protection devices. Fit testing can be integrated into an ongoing training or health surveillance programme.
3. Can provide useful documentation and record keeping regarding hearing protector suitability and adequacy.
4. Can be used as a tool to assess the overall effectiveness of an employer's hearing conservation programme and to direct corrective actions where needed.
5. Can enable the hearing conservation professional to match the employee's hearing protector attenuation to his/her noise exposure level. This may be particularly useful in hearing-critical jobs or for those with hearing impairment.
6. Can aid in the selection of appropriate hearing protection for staff, where a variety of protectors can be tested and the most effective model selected for that individual.

IN SUMMARY

Since laboratory-based attenuation values cannot be relied upon for individual users and given the importance of hearing protection as a commonly applied final level of protection against harmful noise; the UKHCA supports individual hearing protector fit testing although it cannot recommend any specific method.

Fit testing can lead to a better understanding of the protection actually being achieved in practice and provide a proactive approach to highlight areas of improvement for intervention.

As an outcome of fit testing, issues identified can be addressed by further training, alternative types of hearing protection and other measures to reduce noise at source. When undertaken on a regular basis it can provide a means to educate and reinforce messaging around hearing conservation.

The UK Hearing Conservation Association believes that those organisations relying on hearing protection as a key measure for control of noise exposure should incorporate fit testing as an integral part of their hearing conservation programme to act as a practical component of assurance.

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This document has been produced by the UK Hearing Conservation Association as an information document for those wishing to understand the value and options when considering fit testing as part of a hearing conservation programme.

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