



Noise regulation, headphone limiters and level limited headphones

For many years it has been recognised that working in a 'noisy' industry (e.g. mining, steel making, shipbuilding) raised the likelihood of hearing damage or tinnitus in later life. This effect, referred to as Noise Induced Hearing Loss (NIHL), and its prevention, lay at the heart of the earliest regulations governing the control of noise in workplaces.

Not unsurprisingly, the earliest controls concentrated on those 'heavy' industries where the risks appeared greatest. Perhaps the use of the word 'noise' with its common definition 'unwanted sound' misled people into giving less attention to sounds, such as loud music, which also had the potential to cause NIHL.

Despite the ability of a symphony orchestra in full ensemble to generate sounds of over 100 decibels, the idea that this was 'noise' seemed almost vaguely offensive. However the introduction of powerful PA stacks, particularly by the 1970s heavy metal bands began to focus attention on the fact that even sounds which were intended to be for pleasure could, nonetheless, be harmful.

It was this increased awareness of such risk that led to the steps being taken in the audio and broadcasting industries to mitigate the problems and one of the risks identified was that of the prolonged use of headphones by, for example, sound recordists and TV cameramen. Even before any solutions to this problem could be considered, a number of difficult technical issues had to be overcome, such as agreeing on a standardised way of measuring exposure from such sources and on what levels of exposure should be tolerated.

Over the last 25 years a number of technical solutions to the problem of how to limit sound exposure from headphones have been introduced, including some extremely sophisticated designs which digitally monitor and adjust the user's exposure to compensate for the amount of time for which the device is in use, as well as some more basic designs which simply define a maximum level that the headphone can produce.

The level limiting products offered by Canford stem from a set of design work by the BBC in the 1980s. There are a number of criteria which set the objectives of the range of products and these are (in no particular order):

- That no power source (apart from the audio signal) is available
- That users may plug the headphones into any available outlet (subject to avoiding 'loading' programme circuits)
- That users can not readily 'bypass' the protection limiting device
- That audio performance up to the point of limiting operation should be minimally affected by the limiting device
- That the device should fail 'safe'
- That devices should be available for the widest range of commercially available headphones and headsets
- That devices should allow a range of limiting levels to be set as appropriate for a range of use and exposure subject to a professional risk assessment

Devices which generally meet the criteria above stand a good chance of providing a suitable level of protection to users against exposure to levels greater than those defined in noise regulations and, from a management perspective, reduce the risk of employees avoiding the protection measures.

The Canford limiters based on the BBC designs generally follow the criteria and are under constant development and review.

Noise Regulation in the UK

The Control of Noise at Work Regulations 2005 (the Noise Regulations) came into force for all industry sectors in Great Britain on 6 April 2006 (except for the music and entertainment sectors where they came into force on 6 April 2008).

The aim of the Noise Regulations is to ensure that workers' hearing is protected from excessive noise at their place of work, which could cause them to lose their hearing and/or to suffer from tinnitus (permanent ringing in the ears).

The Control of Noise at Work Regulations 2005 replaced the Noise at Work Regulations 1989.

The level at which employers must provide hearing protection and hearing protection zones is now 85 decibels (daily or weekly average exposure) and the level at which employers must assess the risk to workers' health and provide them with information and training is now 80 decibels. There is also an exposure limit value of 87 decibels, taking account of any reduction in exposure provided by hearing protection, above which workers must not be exposed.

Advice on, and enforcement of, the regulations in the UK is provided by the Health and Safety Executive.

Limit Levels

Intuitively, it may seem obvious that if the allowable average limit of exposure over a working day or a working week is 85dB, then setting headphones to limit at 85dB is the obvious solution, since in that condition a user could wear the headphones continuously without exceeding their exposure limits. This approach is indeed taken by some users but it is not always appropriate or desirable to have the limit set quite so low. There are a number of situations where the ability to listen at levels in excess of the average is helpful and, subject to assessment, this need not involve high risk of over exposure.

As an example, it may be acceptable with certain types of programme material to fix a limit of 88dB, having first assessed that the dynamic range of the material is such that even with the higher limit, the average level is less than 85dB. This approach is also helped by the working assumption that users will set volume levels such that the peaks do not cause the limiter to operate as this is unpleasant, so most of the material will be heard at levels which can be substantially less than the 'peak'.

There is no single rule to apply when deciding what limit level is appropriate for a given situation, but the following points should be considered:

- The type of programme material is relevant. Typical popular music content will have significantly less dynamic range (the difference between the loudest and quietest sounds) than uncompressed speech. This could mean that the average exposure level even if the limiter was operating might differ between different types of material by up to 10 decibels.
- The time for which the headphones are worn and the amount of noise in the environment when they are not being worn have to be considered when assessing exposure risk.
- Remember that decibels are logarithmic values. Thus sounds which are 3 decibels louder are twice as loud. This means that if your limit level is 88 decibels you should consider only using this for half the amount of time that you would use a limit of 85 decibels.
- If you used a limit of 85 decibels for 8hrs with the headphones constantly limiting, the equivalent amount of constant use at a constantly limited level of 93 decibels would be 1.25hrs to achieve similar exposure.
- Owing to the way in which Canford limiters operate, it would be expected that users would not normally listen in limit mode thus reducing nominal exposure values. Common practice is to set the amplifier such that the headphones do not reach limiting values for normal programme content.
- If you are aware of some of the issues above and wish to calculate typical exposure over a day or a week, you may find the noise exposure calculator on the Health and Safety Executive's website helpful. Just search on 'noise exposure calculator'.