

HARM[®] VIBRATION METER APPLICATION NOTES - THE HUMAN FACTOR



'In 1991, the Department of Social Security paid out more compensation for VWF (Vibration White Finger) than for any other industrial disease'.

What is HARM[®]?

HARM[®] stands for Hand Arm Risk Measurement and refers to the process of carrying out Risk Assessments on Employees who are likely to come into contact with Hand Transmitted Vibrations (HTV) or are involved in Repetitive actions. This can often lead to injury, absence and ever increasing compensation claims for recognised industrial diseases such as Vibration White Finger (VWF).

Why bother carrying out yet another Risk Assessment?

Vibration in industry is already covered by common law with numerous test cases! It is also likely to become an area of Statute in much the same way as COSHH and Noise at Work etc. There is already a proposal for legislation, which has been published by the European Commission, looking at '**Physical Agents**' which includes Noise, Vibration, Optical Radiation and Fields and Waves. There are also **HSE guidance** notes as well as British and International Standards covering the subject in quite some detail, for example **BS6842** and **ISO5349**, which both contain Guide-lines for the measurement and assessment of human exposure to hand-transmitted vibration. If this isn't enough, large compensation claims are now all too common and insurance companies are demanding assessments.

What is to be measured?



All the documents mentioned refer to the same parameters and terminology and they all say that the risk of injury to any part of the hand and arm from occupational vibration must be assessed in terms of risk and that appropriate action must then be taken.

To do this, each document states that, if in doubt, you must establish an 8 hour Vibration Exposure, A_8 (much the same as LEP'd in Noise assessments and now with the introduction of the GA2001 and GA2003 HARM[®] vibration Meters from Castle, an easy task), you then use this measurement to determine the level of Risk and the action required.

A_8 daily exposure for HARM[®] is defined in much the same way in each of the documents. Essentially, it is a frequency weighted RMS. value of the vibration acceleration, based on an 8 hour working day. The Standards set out the frequency weighting, which is a bit like 'A' Weighting for the human ear. This is called the HARM[®] filter in the GA2001 and the GA2003. The rest of it means that you need to measure an average acceleration (a bit like Leq in noise) and calculate an exposure figure based on a working day of 8 hours.



INVESTOR IN PEOPLE



Is There a Recommended Level for 8 Hour Exposure?

All the different sources treat recommended levels for 8 hour exposure in different ways. The first one of these to look at is the European Proposal for a Physical Agents Directive as this may well become law before much longer. When this document was first introduced in 1994, it covered Noise, Vibration, Optical radiation and fields and Waves. The vibration section detailed five separate levels at which different actions were prescribed. In January 1999, a revised version was published focusing solely on human vibration and now detailing only two action levels although both of those are to be assessed for an 8 hour day and a 10 minute (short duration) exposure expressed as $A(1/6)$.

This new document also specifically states that any measurements taken must be tri axial. This means that the vibration must be measured in 3 component directions and then 'added' back together as a root sum of squares (rss) to give the overall vibration level. Details of how to do this are already available in the HSE guidance

2.5m/s² A(8) or 17.5m/s² A(1/6): Assessment, measurement and evaluation of exposure must be carried out Risk must be reduced Information and training must be supplied to workers Workers are also entitled to regular health surveillance Personal Protective equipment, when it becomes available, shall be used.

5m/s² A(8) or 35m/s² A(1/6): This is called the Exposure Limit Value (ELV) and exposure above this level is prohibited Equipment must be marked Activities must be declared to the HSE.



What is the HSE guidance on exposure levels?

The HSE (Health and Safety Executive) does have a publication called "Hand-Arm Vibration" (of course) with the reference number HS(G)88. This is available from HSE Books and does cover many more aspects than this leaflet and in much more detail. As far as action levels are concerned, the current HSE recommendation is for one action level at 2.8m/s^2 (single, dominant axis) which, according to BS6842, is the level at which, for an 8 hour daily exposure over 8 years, there is a 10% chance of injury. At this action level, programmes of preventative measures and health surveillance are recommended.

The approach of the Standards to exposure levels is to give the percentage chance of damage for a given daily exposure over a given number of years. Hence the HSE approach in selecting one of these levels. The British and International standards both seem to give the same figures, although they are presented differently.

What are the practicalities of carrying out HARM®?

You may have noticed quite a lot of similarities to noise up to this point in the way the legislation sets out action levels and the type of measurements, well that's about where the similarity ends. Taking human vibration measurements is quite different to noise monitoring and the reason, due to the nature of vibration, is the method of detection.

How is vibration measured?

To measure vibration, a physical contact is normally made with a vibrating surface, this is done with an accelerometer, which is a piezo-electric crystal mounted usually in a metal block with a connector on the outside. When there is a movement (vibration) the crystal creates a small electric current which is then measured to gauge the level of vibration. The next problem is mounting the accelerometer to take some measurements.

How do you take measurements?

Vibration transducers, unlike most microphones, are very directional and therefore will predominantly measure the vibration in one plane only. This means that to get an overall picture of the vibration you must take 3 readings in three axes often called X, Y and Z (you could say measurement in 3D!). Once you have three results you can add them together using an RMS formula to give you a 'root sum of squares (rss)' or 'resultant force' or you can see if there is one axis which is double any of the others and use this result (the dominant axis method). The dominant axis result is what the HSE refer to in the guidance when quoting the action level of 2.8m/s^2 . The GA2001 HARM® Meter measures the axes sequentially and then it presents the three axes individually as well as giving the vector sum. It will also calculate the vibration exposure for a series of measurements so you can use it to automatically accumulate the exposure from various different machines that an employee may use. The Castle GA2003 can either be used as a Dosemeter that is worn for all of part of the working day or it can be used to carry out the dominant axis test with a single accelerometer.

What mountings and fixings can be used?

This is where the whole subject gets a bit tricky as the accelerometers need to be physically in contact with the vibrating surface. The HSE booklet recommends that the transducer(s) be directly fixed (e.g. by drilling and tapping the actual tool or using glue) this can be very difficult in practice in many situations. The next recommended method is the handle bar attachment shown in figure 1 which is attached with cable ties, jubilee clips or glue! This, however is only single or dual axis which does contradict the recommendation for making tri-axial measurements. There is also a general purpose block recommended which does have tri-axial mounting and is designed for cable ties shown in figure 2. The limitation of this method is that it is not attached at the same position as the hand and therefore cannot be truly representative

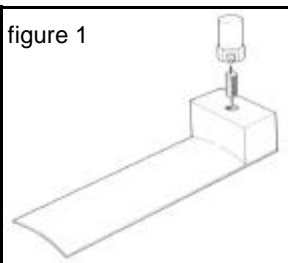


figure 1

Are there any new or alternative methods?

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Figure 3 shows a diagram of Castle's HARM BLOK® which has been designed to overcome many of the limitations mentioned above. The principle is that this tri-axial mounting device is firmly attached onto the power tool at the hand position so that the operators hand fits around the shank of the block. This means that the vibration is measured at the same point of contact as the hand.

This is very important as vibration levels will vary considerably at different points along a power tool. As this is not one of the HSE recommended methods, care should be taken to ensure that results are consistent with a more direct fixing by taking reference measurements using one of the above mentioned applications.

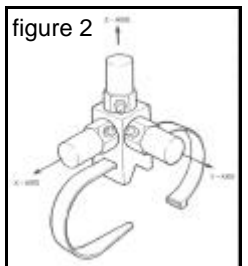


figure 2

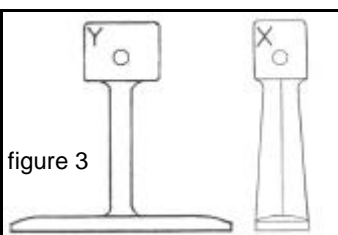


figure 3

Scope and Application of use

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The GA2001 is suitable for the assessment of hand-Arm Vibration as described in the above standards on hand held power tools. The vibration from percussive tools can contain very high level, high frequency vibration. Where percussive tools are used, the dynamic range of the GA2001 means that it is not suitable for measurement to ISO8041

What do I do next?

At Castle, we have spent thousands of hours finding the best ways to overcome many of the practical problems of carrying out HARM® and this is backed up by 25 years of experience in vibration as a subject on its own. In short, we will be able to help you to get a HARM® programme off the ground. We can offer, not only products, but back-up assistance and training, as well as consultancy should this suit your needs better. Look out for our one day introduction training sessions or give us a call on **01723 584250** to arrange a no obligation quotation or demonstration.