
HAND-ARM VIBRATION

Workers using hand-held power tools in workplaces can be exposed to harmful levels of hand–arm vibration. Reducing vibration exposure and/or duration of use reduces the risk of musculoskeletal disorders.

What is hand–arm vibration?

Hand–arm vibration (HAV) is vibration transmitted to the hand and arm during the operation of hand-held power tools and hand-guided equipment, or holding materials being processed by machines. Hand–arm vibration is commonly experienced by workers who regularly use tools such as jackhammers, chainsaws, grinders, drills, riveters and impact wrenches.

Health effects

Exposure to HAV can result in disrupted circulation in the hand and forearm and/or damage to nerves and tendons, muscles, bones and joints of the hand and arm. It can cause a range of conditions collectively known as hand–arm vibration syndrome (HAVS) and specific disorders such as carpal tunnel syndrome, ‘tennis elbow’ and ‘vibration white finger’.

Workers with exposure to vibration while performing other hazardous manual tasks may also experience

- pain in the hands and arms
- diminished muscle strength.

Longer exposure periods, i.e years, may result in episodes of whitening of the fingers, usually triggered by cold exposure. This is from temporary closing down of blood circulation to the fingers.

Workers who use equipment that subjects the worker to both HAV and to noise may also be more likely to suffer from hearing loss.

Factors influencing the effects of exposure to HAV

The longer a worker using tools is exposed to HAV, the greater the risk of developing HAVS.

Exposure to hand–arm vibration can be increased by factors such as:

Tool characteristics:

- Higher magnitude of acceleration of vibration
- Poor tool maintenance
- Minimal handle insulation

- Increased weight of tool
- increased surface area of hand in contact with tool
- harder material being contacted

Work organisation:

- Long exposure during each work shift and years of exposure
- lower duration and frequency of rest periods
- lower temperature of work environment

Individual's characteristics:

- gripping the handle more tightly than needed
- Awkward postures and working overhead
- Low operator skill ; poor technique
- individual lifestyle factors (e.g. smoking)
- an individual's medical history(e.g. disease or prior injury to fingers, hands or wrists).

Reducing harmful exposure

Eliminating or minimising exposure to HAV usually involves isolating or cushioning methods. Workers should be consulted and involved in setting priorities and identifying solutions, including the selection and trialling of new powered hand-tools.

Successful HAV exposure reduction usually requires a combination of control measures. Such measures, listed in order of priority include:

- substituting alternative methods or processes to eliminate the need to use vibrating hand-held tools
- selecting tools with low vibration
- emission levels to eliminate or minimise exposure to vibration
- modifying existing tools to either minimise the vibration or prevent the vibration from moving into the handle of the tool
- directing cold air away from the worker's hand
- maintaining equipment regularly to minimise vibration
- modifying work methods to reduce exposure to vibration

- altering work practices and the way work is organised to reduce exposure to vibration

These measures need to be accompanied by training, education and supervision including advice on good work practices and tool maintenance, the effects of individual factors (e.g. smoking and some medications may impact on circulation and vibration white finger), as well as recognising and reporting symptoms of HAVS.

Gloves should not be relied upon to provide protection from vibration. They only provide protection from cold temperatures, water, and cuts and abrasions. The use of thick gloves may worsen exposure by workers applying increased grip forces to the tool and increase transmitted vibration.

Making the right choice

There is considerable variation in emitted vibration between tools of the same type.

Tools that incorporate vibration-reduction innovations in their design, or are manufactured to higher specifications may vibrate less than other tools. To make an informed choice, obtain as much information about the vibration emissions of the tool as possible.

Consider the suitability of hand-held power tools for the work being undertaken - an underpowered or blunt tool may take longer to do the job, increasing the time of exposure, and an overpowered or oversized tool may emit more vibration than necessary.

Information on the vibration emitted by a specific tool can be provided by the tool manufacturer or supplier.

When considering the vibration emitted by a tool during a specific task, try to find data which is measured while undertaking the same task as your intended use. This will provide a better guide to the levels likely to be found in practice when the task is performed in the workplace.

Data from suppliers and some workplace data are available on the Internet. A useful website is:
<http://www.vibration.db.umu.se/HavSok.aspx?lang=en>

Are there mandatory exposure levels?

No, not yet in Australia. In Europe there are mandatory requirements which may be used as a guide. You should select tools that can be used with the daily vibration exposure of a user remaining below 2.5 m/s² averaged over an 8 hour working day. If this is not achievable, consider changing or rearranging the task so this can be met. Sometimes it is not possible to reduce exposure to below 2.5 m/s², however you should never allow a worker to be exposed to more than 5 m/s² over an 8 hour day.

A 'ready- reckoner' for calculating daily vibration exposure is available at:
<http://www.hse.gov.uk/vibration/hav/readyreckoner.htm>

To make use of this, you will need to know the vibration magnitude (in m/s²) from the manufacturer and exposure time. Exposure time is the time the tool is operational, and can easily be measured by an observer with a stopwatch during normal working conditions.

The ready-reckoner can provide workers with an indication of how long they can work before the recommended action level and exposure limit levels would be exceeded.

Is it necessary to measure vibration levels?

No. It should only be necessary for expert measurement of vibration exposure in situations where there is no information on the emission of the tool, the vibration levels are likely to be high, and the tool is used for long periods of time. You can put controls in place to minimise exposure without measuring.

Further information

- SAFE WORK AUSTRALIA, 2011, National Code of Practice for Hazardous Manual Tasks.

This Code provides guidance risks involved in manual tasks. The code is available at www.safeworkaustralia.gov.au

- International Standard ISO 5349-1:2001 Mechanical vibration – measurement and evaluation of human exposure to hand-transmitted vibration – Part 1: General requirements. This standard can be purchased at www.saiglobal.com/shop
- HEALTH AND SAFETY EXECUTIVE, 2005, Control the Risks from Hand–Arm Vibration – Advice for Employers on the Control of Vibration at Work Regulations 2005:

HSE, Sudbury, UK, 12 pp. (Also see Hand–Arm Vibrations – Advice for Employees). Both of these are available at: <http://www.hse.gov.uk/vibration/hav/publications.htm>

Web-based tools

Web-based calculators are available that simplify the process of doing daily vibration exposure calculations, e.g.: <http://www.hse.gov.uk/vibration/hav/vibrationcalc.htm>

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