



## MLN 4.3(B)

Revision No 0

DEPARTMENT OF ECONOMIC DEVELOPMENT

### **MLN 4.3(B) Health and Safety - Vibration**

This MLN is part of a series of MLNs which provide guidance on compliance with Isle of Man regulations which give effect to MLC 2006 Title 4.3. Implementation of these guidelines will be taken as evidence of compliance with the Isle of Man regulations.

The guidelines do not preclude the shipowner from demonstrating an equivalent or higher standard as an "alternative method" of evidence of compliance.

Documents referred to in this notice:

Maritime Labour Convention 2006 (MLC);

Health and Safety Executive publications: Control the risks from hand-arm vibration INDG175 and Control back-pain risks from whole-body vibration INDG242;

ILO Code of Practice; Ambient Factors in the Workplace, Geneva 2001;

Maritime and Coastguard Agency publications: Code of Practice for Controlling Risks due to Whole-body Vibration on Ships and Code of Practice for Controlling Risks due to Hand-transmitted Vibration on Ships;

BS EN ISO 5349-1:2001 and ISO 2631-1:1997.

Most regulations and notices are available on the Isle of Man Government website:

[www.iomshipregistry.com](http://www.iomshipregistry.com) or by contacting [marine.survey@gov.im](mailto:marine.survey@gov.im)

### **Protecting seafarers from exposure to vibration**

This Maritime Labour Notice forms part of a series of MLNs for MLC Regulation 4.3 health and safety protection and accident prevention.

MLC regulation 4.3 requires reasonable precautions are taken to reduce and prevent the risk of exposure to harmful levels of ambient factors and chemicals on board the vessel. Harmful levels of ambient factors include vibration and this MLN explains the Ship Registry regulations and where necessary gives guidance on how to protect seafarers from the adverse effects of vibration on board ships.

During MLC inspections the surveyor will be checking to ensure that a risk assessment has been carried out and the levels of mechanical vibration on the vessel have been evaluated. Where there is evidence that there is a risk to seafarers to the exposure from vibration or any of the exposure values have been exceeded the surveyor will also be looking for evidence that the appropriate action as described in this MLN has been taken.

## **SECTION 1**

### **Introduction**

#### **Why seafarers should be protected from exposure to vibration**

Mechanical vibration is vibration that occurs in a piece of machinery or equipment, or on a ship as a result of its operation. Mechanical vibration can cause severe back pain and long-term damage to hands and fingers. There are two types of mechanical vibration to be considered; hand-arm vibration and whole-body vibration.

**Hand-arm vibration** is mechanical vibration which is transmitted into the hands during a work activity such as using hand-held power tools, for example needle scalers or angle grinders. Regular and frequent exposure to hand-arm vibration can lead to permanent health effects collectively known as hand-arm vibration syndrome, as well as specific diseases such as carpal tunnel syndrome. This is most likely when contact with a vibrating tool or work process is a regular part of a seafarer's job. Occasional exposure is unlikely to cause ill health.

**Whole-body vibration** is mechanical vibration which is transmitted into the body through the supporting surface when seated or standing during a work activity, for example, riding in a rescue boat in choppy seas. One of the primary health effects of whole-body vibration can be back pain.

## SECTION 2

### Risk Assessment

#### 2.1 Risk Assessment for mechanical vibration

It is the shipowner's responsibility to ensure the levels of mechanical vibration to which seafarers are exposed are assessed as part of a risk assessment. The risk assessment shall be based on -

- a. observation of specific working practices. This can be carried out by speaking to seafarers on the vessel and their heads of department to find out if any of the shipboard tasks involve regular exposure to vibration, examples of this could be -
  - i. seafarers are regularly using machinery such as needle scalers, floor polishers or angle grinders;
  - ii. there are uncomfortable magnitudes of vibration emanating from the vessel itself; and
  - iii. seafarers are operating small craft at high speeds.
- b. information provided by the manufacturer of the equipment and any other relevant information on the probable magnitude of vibration in the particular conditions of use; and
- c. if necessary a measurement of the level of mechanical vibration to which seafarers are likely to be exposed.

In determining if seafarers are at risk from exposure to mechanical vibration the following shall be considered -

- a. the level, type and duration of exposure, including any exposure to intermittent vibration or repeated shocks;
- b. the *exposure limit values* and the *exposure action values*, and if they have been exceeded;
- c. the health and safety of seafarers who may be particularly sensitive to mechanical vibration: for example if a seafarer has an existing medical condition such as back pain;
- d. any indirect effect on seafarers safety which may be caused by interaction between equipment subject to mechanical vibration and the workplace or other work equipment;
- e. the existence of replacement equipment designed to reduce exposure to vibration;
- f. the extension of exposure to whole-body vibration beyond normal working hours;

- g. the effect of specific working conditions, such as low temperatures; and
- h. appropriate information obtained from health surveillance, including published information, so far as possible.

The risk assessment shall –

- a. record the significant findings, any measures the shipowner has taken or intends to take to eliminate or control the exposure to vibration and any information and training required to be given to the seafarers;
- b. (if appropriate) explain the reason why measurements of the levels of vibration have not been considered necessary;
- c. be retained on the vessel for inspection purposes.

The vibration assessment will have to be reviewed if there are any significant changes in work conditions or if any health surveillance undertaken indicates a seafarer's health is being affected. Vibration levels can increase on a ship over time due to wear on machinery or a change of work equipment so it is good practice to review the risk assessment at two yearly intervals.

## SECTION 3

### Measurement and evaluation of exposures to vibration

#### 3.1 Maximum exposure levels

The *daily exposure action value* and *daily exposure limit value* are as follows -

	<b>Hand-arm Vibration</b>	<b>Whole-body Vibration</b>	<b>Action Required</b>
<b>Daily Exposure Action Value*</b>	2.5m/s <sup>2</sup>	0.5m/s <sup>2</sup>	Above this limit, the shipowner is required to - a) reduce the seafarer's exposure; b) implement a programme of organisational or technical measures; and c) provide seafarers with information, instruction and training.
<b>Daily Exposure Limit Value*</b>	5.0m/s <sup>2</sup>	1.15m/s <sup>2</sup>	This is the <u>maximum</u> amount of vibration a seafarer may be exposed to on any single day. If the vibration levels are above this limit the shipowner shall identify the reasons why the limit has been exceeded and take action to reduce the exposure below this value. The organisational or technical measures shall be amended to ensure the limit is not exceeded again.

\*Standardised to eight hour reference period

*Daily exposure* is the quantity of mechanical vibration to which a seafarer is exposed during a working day, taking into account the magnitude and duration of the vibration.

#### 3.2 Evaluation of exposures to vibration

Following the risk assessment it may be determined that it is not necessary to measure the levels of mechanical vibration on the vessel. This may be for the following reasons –

- the handbooks for the mechanical machinery used by seafarers state the vibration levels are of a low value and when compared with the duration the seafarers use machinery it is concluded the seafarer's exposure will be below the *exposure action values* ;
- the vessel's rescue boat is only used for short durations and the seafarers have been instructed in how to operate the boat to minimise vibration;

- following interviews with the seafarers it is concluded that certain areas of the vessel are subject to vibration, however in these areas the vibration does not cause any discomfort and is considered to be of a low level.

The reasons why the levels of mechanical vibration have not been measured will have to be recorded on the risk assessment.

If the risk assessment does indicate that some vibration exposures are likely to be above the *exposure action value* then it would be advisable to have measurements taken to help determine if an *exposure limit value* has been exceeded. Alternatively organisational or technical measures could be implemented to reduce the risk (refer to Section 4).

Any measurements taken may include sampling which must be carried out to accurately represent the *daily exposure* of a seafarer to the mechanical vibration being assessed. Measurements must also take account of the particular characteristics of the mechanical vibration to be measured, ambient factors and the characteristics of the measuring apparatus.

### 3.3 Evaluation of hand-arm vibration

If sufficient data is available from tool manufacturers it should be possible for a non-specialist to make an adequate estimate of vibration magnitudes. This can be carried out by using the following method to estimate the *daily exposure* for a seafarer -

- a. the total daily duration of exposure to the vibration from each hand-tool or process being used has to be calculated. The important information is the "trigger time" which is the time that the seafarer's hands are actually exposed to the vibration from the hand-tool or equipment. For devices which need to be held with both hands, measurements must be made for each hand, then the exposure shall be determined using the higher value; and
- b. the relevant vibration data for the equipment has to be obtained, this should be stated in the manufacturer's handbook.

By using this information the seafarer's daily exposure can be estimated by using the exposure calculator which can be found on the UK's Health and Safety Executive (HSE) website - [www.hse.gov.uk/vibration](http://www.hse.gov.uk/vibration) . This method can be used to calculate up to six different tools or processes in order to determine the total daily exposure.

The conclusion of the risk assessment may be that more detailed measurements are required. This can be a complex task and the person delegated to carry out the measurements will have to have sufficient competence and experience in carrying out vibration measurements, including –

- a. a thorough understanding of the measurement and analysis of hand-transmitted vibration according to BS EN ISO 5349-1:2001 (*refer to Section 8*); and
- b. training and practical experience in performing vibration testing on hand-tools.

Further details for measuring and evaluating exposures to hand-transmitted vibration can be found in the Maritime and Coastguard Agency publication: Code of Practice for Controlling Risks due to Hand-transmitted Vibration on Ships.

### 3.4 Evaluation of whole-body vibration

It is not always necessary to measure seafarers' exposure to whole body vibration and on most vessels the daily exposures will be below the limit value. It is generally the smaller fast craft when operated in conditions that generate high levels of vibration or jolting that may exceed the *exposure limit value*. In most circumstances it is likely to be more effective for shipowners to direct their efforts towards controlling the risks rather than trying to assess vibration exposures precisely.

If the decision is made to check the vibration levels the information in the manufacturer's handbook can be referred to, or the data published on the HSE website and the exposure calculator can be used - [www.hse.gov.uk/vibration](http://www.hse.gov.uk/vibration)

The person making the measurements must have sufficient competence and experience including -

- a. having a thorough understanding of the method of measuring and evaluating exposures defined in ISO 2631-1:1997 (*refer to Section 8*); and
- b. training and practical experience in performing vibration testing.

Further details for measuring and evaluating exposures to whole-body vibration can be found in the Maritime and Coastguard Agency publication: Code of Practice for Controlling Risks due to Whole-body Vibration on Ships.

## SECTION 4

### Elimination or control of exposure to vibration in the workplace

#### 4.1 Reducing the risks

The vibration regulations require that any risks arising from exposure to mechanical vibration which are identified by the risk assessment are to be eliminated at their source. Where this is not possible and an *exposure action value* is likely to be exceeded, the exposure shall be reduced to as low as is reasonably practicable by establishing and implementing a programme of organisational or technical measures appropriate to the activity. These measures may include -

- a. looking for other working methods which eliminate or reduce exposure to vibration;
- b. providing work equipment of appropriate ergonomic design which produces the least possible vibration. For example: when purchasing a new hand-held sander, compare the vibration emission data for different models;
- c. vibration can be caused by wear and tear or misalignment of components, this can be reduced by implementing appropriate maintenance programmes for work equipment, the workplace and workplace systems;
- d. improving the design and layout of workplaces and work-stations to minimise loads on seafarers hand's, wrists and arms caused by poor posture;
- e. providing adequate information and training to seafarers to ensure that work equipment is used correctly and safely in order to reduce exposure to mechanical vibration;
- f. if seafarers are regularly using equipment such as chipping hammers, limits can be imposed on the duration and intensity of the use of such equipment;
- g. providing protective clothing to keep seafarers warm and dry. This encourages good blood circulation which helps to protect against developing vibration white finger;
- h. adapting measures to seafarers who are particularly sensitive to vibration; and
- i. taking into account the results from any health surveillance that has been carried out.

## SECTION 5

### Daily exposure limit value

5.1 Seafarers must not be exposed to mechanical vibration exceeding the *daily exposure limit value*.

Following the implementation of the organisational or technical measures described in Section 4 the effectiveness of such measures shall be re-assessed and if the *daily exposure limit value* has been exceeded the shipowner shall -

- a. identify the reasons why the limit has been exceeded;
- b. take such action as is necessary to reduce exposure to vibration to below the *exposure limit value* ; and
- c. amend the organisational and technical measures already taken to ensure that the limit is not exceeded again.

## SECTION 6

### Information, training and health surveillance

#### 6.1 Seafarer information and training

If seafarers are likely to be exposed to mechanical vibration in excess of an *exposure action value* the shipowner shall provide suitable information, instruction or training, to help seafarers minimise their exposure as far as practical to the effects of vibration, this may include -

- a) the health effects of hand-arm and whole-body vibration;
- b) the measures taken in order to eliminate or reduce to as low as reasonably practicable the risks from mechanical vibration;
- c) the *exposure limit values* and the *exposure action values*;
- d) the circumstances in which seafarers are entitled to health surveillance;
- e) the potential injuries which may arise from the work equipment in use;
- f) ways to minimise risk which may include; changes to working practices, correct maintenance of equipment and correct techniques for equipment use; and
- g) how to detect and report any health concerns related to mechanical vibration.

#### 6.2 Health surveillance

The risk assessment may require that seafarers are to be provided with health surveillance. The intention of health surveillance is to help prevent and diagnose rapidly any disorder linked with exposure to mechanical vibration.

Health surveillance can be carried out by –

- regularly seeking information from seafarers by using a questionnaire; or
- using an occupational health service provider to carry out the service.

The results from health surveillance should be reviewed and analysed to check if the risk controls are working. The seafarers shall always be informed about the results of any health surveillance and any personal information about the health of individual seafarers shall be treated as confidential.

## SECTION 7

### Exemptions

#### 7.1 Whole-body vibration and hand-arm vibration

The Ship Registry may allow the *exposure limit value* to be exceeded in relation to whole-body vibration or hand-arm vibration where the seafarer is exposed to mechanical vibration which is usually below the *exposure action value* but which varies significantly from time to time and sometimes exceeds the *exposure limit value*. Before an exemption is issued under this circumstance the following conditions must be met –

- the exposure value averaged over 40 hours is less than the exposure limit value;
- there is evidence to show that the risks from the pattern of exposure are lower than those from exposure at the *exposure limit value*; and
- the seafarers concerned are subject to health surveillance to a level considered appropriate by the Ship Registry.

#### 7.2 Application for an exemption

The application for exemption will need to cover the following areas –

- include a copy of the risk assessment and detail the work procedure for which the exemption is sought, information on the seafarers affected, and the equipment used including frequency and length of use;
- detail the health surveillance that will be taken to monitor the safety of the seafarers concerned and the steps being taken to reduce the risks; and
- qualified advice (such as from an occupational physician) may be used as supporting evidence.

## SECTION 8

### Standards used in this MLN

The following standards have been used in this MLN

#### 8.1 Hand-arm vibration

'BS EN ISO standard 5349-1' means the British Standard publication "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration Part I: General Requirements";

The person carrying out the assessment of the level of exposure to hand-arm vibration shall base the assessment on the following calculation, which is defined in chapters 4 and 5 and Annex A to BS EN ISO standard 5349-1 -

*the daily exposure value shall be normalised to an eight hour reference period  $A(8)$ , and expressed as the square root of the sum of the squares (rms) (total value) of the frequency weighted acceleration values, determined on the orthogonal axes  $a_{hw_x}$ ,  $a_{hw_y}$ , and  $a_{hw_z}$*

#### 8.2 Whole-body vibration

'ISO 2631-1' means the International Organisation for Standardisation publication "Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Part 1: General requirements";

The person carrying out the assessment of the level of exposure to whole-body vibration shall base the assessment on the following, which is in accordance with Chapters 5, 6 and 7, Annex A and Annex B to ISO standard 2631-1 -

*the calculation of daily exposure expressed as equivalent continuous acceleration over an eight hour period, calculated as the highest (rms) value, determined on three orthogonal axes ( $1,4a_{wx}$ ,  $1,4a_{wy}$ ,  $a_{wz}$  for a seated or standing seafarer);*

Assessment of whole-body vibration need only include vibrations of a frequency exceeding 1 hz.

#### 8.3 Definitions

'Acceleration' means the quantity used to represent vibration magnitude in units of metres per second per second ( $m/s^2$ );

'orthogonal axes' means the three directions of vibration which are at right angles to one another.

## Control of vibration on Isle of Man registered vessels

