HAND-ARM VIBRATION

HANDOUT BOOKLET

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1.0 HAND-ARM VIBRATION

Introduction

1.1 This handout booklet is a summary of what you need to consider with regards to Hand-arm vibration and is based upon the advice offered in the HSE guidance [including L140 and its website, see Section 2] and focuses upon practical application. These control the primary guidance offered by the HSE in relation to compliance with The Control of Vibration at Work Regulation 2005.

Legal Duties - Hand-arm Vibration

1.2 The Control of Vibration at Work Regulations 2005 (the Vibration Regulations) came into force in the UK on the 6 July 2005. These regulations require that risks from vibration are eliminated or minimised, and require specific actions according to daily exposure action and limit values, set in terms of a daily vibration 'dose', the *A*(8):

- The daily Exposure Action Value (EAV) is 2.5 m/s^2 *A*(8) or 100 HAV Points;

- The daily Exposure Limit Value (ELV) is 5 m/s^2 *A*(8) or 400 HAV Points.

1.3 Employers should make an assessment of the risk posed to their employees from exposure to hand-arm vibration and must take action to eliminate the risks from vibration exposure completely, wherever it is reasonably practicable to do so.

1.4 The ELV must not be exceeded.

1.5 Where the EAV is likely to be reached or exceeded, a programme of technical and organisational measures is required, to reduce the exposure to as low a level as is reasonably practicable. Consideration should be given to the possibility of introducing alternative processes, better equipment and/or better working methods that would eliminate or reduce employee's exposure. Health surveillance is also required where exposures are likely to exceed the EAV or where there is a risk to health.

1.6 In the HSE guidance on the 2005 Regulations, L140, regards exposure below the Exposure Action Value (EAV) of 2.5 m/s^2 *A*(8) it says:

'Your exposure estimate will only be soundly based if it uses data which can be judged to be reasonably representative of your work process. In most cases where the assessment evidence suggests that exposure is unlikely to exceed the EAV, it is sufficient to record that fact, though you are still required to reduce risk to as low as reasonably practicable (ALARP). Some employees, e.g. those with existing health problems, may be at risk from exposures below the EAV and need to be protected by additional control measures. If exposure is likely to be above the EAV, a more systematic assessment will be required.'

1.7 Annex C of BS 5349-1 discusses the relationship between vibration exposure and effects on health, noting:

'Studies suggest that symptoms of the hand-arm vibration syndrome are rare in persons exposed with an 8-h energy-equivalent vibration total value, A(8), at a surface in contact with the hand, of less than 2 m/s^2 and unreported for A(8) values of less than 1 m/s^2.'

1.8 Daily vibration exposures below 1.0 m/s^2 *A*(8) are generally regarded as negligible, unless there are exceptional circumstances. As such, daily exposure below 1 m/s^2 do not generally have any duties placed upon the employer. On this basis, and considering the advice given by HSE in L140 and BS 5349-1 [see above], ASL would expect an employer with an expected daily vibration exposure above 1 m/s^2 *A*(8) and up to the Exposure Action Value (EAV) of 2.5 m/s^2 *A*(8) to reduce the risks from vibration to as low as reasonably practicable.

1.9 In ASL's experience, reducing the risk from vibration to as low as reasonably practicable for a regular tool user whose exposure is in the range of 1 to 2.5 m/s^2 *A*(8) would require the employer to:

a) put into place a suitable and sufficient risk assessment;

b) on a sliding scale, a programme of instruction and training and a programme of technical means to reduce the risks from exposure.

1.10 In ASL's experience, if the daily vibration exposure reaches or exceeds the exposure action value [EAV 2.5 m/s^2 *A*(8)], then this would require the employer to:

a) provide information, instruction and training on vibration risk and possible symptoms;

b) take reasonably practicable steps to reduce exposure to vibration, for example by technical or organisational means;

c) provide regular health surveillance;

d) ensure effective supervision and enforcement of any steps (or good working practices) identified to reduce the risks from vibration to as low as reasonably practicable;

e) put into place a suitable and sufficient risk assessment.

1.11 In ASL's experience, if the daily vibration exposure reaches or exceeds the exposure action value [ELV 5.0 m/s^2 *A*(8)], then this would require the employer to:

a) quickly identify the ELV had been reached or exceeded;

b) ensure steps are put into place to ensure this does not re-occur.

Risk Assessment

1.12 The EAV and ELV are based on 'daily exposure' assessments. A person's daily vibration exposure depends on:

a) the vibration magnitudes to which they are exposed;

b) how long the exposures last.

1.13 As a rough guide, HSE advise for a modern, well-designed and maintained tool or machine, the EAV and ELV thresholds are likely to be reached after total use durations, as follows:

a) rotary tool: reach the EAV after 1 hour, and the ELV after 4 hours;
e.g. rotating tools such as angle grinders, circular saws, lawn mower etc.

b) percussive tool: reach the EAV after 15 minutes, and the ELV after 1 hour.
e.g. tools which move/vibrate along an axis such as a breaker, hammer drill (or SDS drill), hedge trimmer etc.

1.14 The Control of Vibration at Work Regulations 2005 states:

'An employer who carries out work which is liable to expose any of his employees to risk from vibration shall make a suitable and sufficient assessment of the risk created by that work to the health and safety of those employees and the risk assessment shall identify the measures that need to be taken to meet the requirements of these Regulations.'

1.15 The HSE advise on the requirements of a risk assessment are outlined in L140 [paragraph 24]. In L140 it describes the requirements of a risk assessment as follows:

'An assessment will be suitable and sufficient if it identifies:

a) where there may be a risk from HAV;

b) a soundly based estimate of your employees' exposures and a comparison with the EAV and ELV;

c) the available risk controls;

d) the identification of those individuals who may be more at risk;

e) the steps you have already taken, or you plan to take, to control and monitor those risks.'

Vibration Magnitude

1.16 Vibration magnitudes of equipment can be found in various way including from the manufacturer, who is required to provide declared vibration magnitudes where relevant. The manufacturer information is generally the easiest to access however caution is required with this information, whether it be from the manufacturer, a reliable database or measured. Please see Section 3 for other examples of sources of vibration magnitude.

2.0 REFERENCES

HSE Supporting Information

2.1 The HSE guidance and relevant standards includes:

a) Control of Vibration at Work Regulations

The Control of Vibration at Work Regulations 2005 - Guidance on Regulations L140. Please see https://www.hse.gov.uk/pubns/books/l140.htm.

b) HSE Vibration Webpage

The HSE website contains additional supporting information on its noise page. Please see https://www.hse.gov.uk/vibration/.

c) HSE Hand-arm Vibration Exposure Calculator

The HSE 'Hand-arm Vibration Exposure Calculator' can be used to calculate HAV exposures based upon vibration magnitude, time exposed and can account for multiple activities.

Please see https://www.hse.gov.uk/vibration/hav/calculator-guide.htm and hav.xlsm (live.com).

d) BS EN ISO 5349-1:2001 "*Mechanical vibration - Measurement and evaluation of human exposure to hand-transmitted vibration - Part 1: General requirements*", published in 2001.

3.0 VIBRATION DATA – INFORMATION SOURCES

Purpose

3.1 Comparison of data from different sources for the same tool:

Makita GA4530R 115mm [4.5”] Grinder

3.2 Manufacturers Handbook – Vibration Information

Vibration

The vibration total value (tri-axial vector sum) determined according to EN60745:

Model GA4030R
Work mode: surface grinding
Vibration emission ($a_{h, AG}$) : 7.0 m/s^2
Uncertainty (K) : 1.5 m/s^2
Work mode: disc sanding
Vibration emission ($a_{h, DS}$) : 2.5 m/s^2 or less
Uncertainty (K) : 1.5 m/s^2

Model GA4530R
Work mode: surface grinding
Vibration emission ($a_{h, AG}$) : 7.5 m/s^2
Uncertainty (K) : 1.5 m/s^2
Work mode: disc sanding
Vibration emission ($a_{h, DS}$) : 2.5 m/s^2 or less
Uncertainty (K) : 1.5 m/s^2

Model GA5030R
Work mode: surface grinding
Vibration emission ($a_{h, AG}$) : 8.5 m/s^2
Uncertainty (K) : 1.5 m/s^2
Work mode: disc sanding
Vibration emission ($a_{h, DS}$) : 2.5 m/s^2 or less
Uncertainty (K) : 1.5 m/s^2

NOTE: The declared vibration emission value has been measured in accordance with the standard test method and may be used for comparing one tool with another.

NOTE: The declared vibration emission value may also be used in a preliminary assessment of exposure.

3.3 Manufacturer's Website – Example Specification Sheet

This information has been replicated for illustrative purposes from the Makita website

Makita Angle Grinder, GA4530R

750 W. 115 mm. 11 000 min^{-1}

Mini-grinder with anti-restart feature for cutting and grinding.

Grinder with anti-restart feature to prevent accidental and unexpected restart of the machine for improved safety. Slim motor housing with small circumference of 179mm for improved grip. High quality motor with excellent heat resistance.

Technical Specifications

Continuous Input Power	720 W
No load speed	11000 min^{-1}
Max. Depth of Cut	30 mm
Spindle Thread	M14 x 2
Grinding Disc Diameter	115 mm
Anti-Restart Function (NVR Switch)	√
Power Supply Cord	2,5 m
Sound Power Level (L_{WA})	96 dB(A)
Sound Pressure Level (L_{PA})	85 dB(A)
Noise Uncertainty (K Factor)	3 dB(A)
Vibration Level (3 axes)	7,5
Vibration Uncertainty (K Factor)	1,5 m/s^2
Weight Without Cable (EPTA)	1,8 – 2,2 kg
Product Dimensions (L x W x H):	266 x 130 x 108 mm
Bore Size (Arbor Diameter)	22,23 mm

User Benefits

- Makita high performance motor with extra long life due to high heat resistance
- The engine compartment labyrinth design protects the engine from the impurities that come with the cooling air
- Spindle lock

EAN 0088381808507
Link to product – www.makitauk.com

HSE Vibration Magnitude Guidance

3.4 HSE Guidance book, L140 "Hand-arm vibration. The Control of Vibration at Work Regulations. Guidance on Regulations" (First edition published 2005, second edition published 2019).

3.5 These contain guidance on HSE vibration magnitudes, please see below an extract of Table 6, angle grinders, Page 65.

Tool characteristic, inserted tool, size, process	Notes	Range – Lower (10th percentile) m/s^2	Range – Upper (90th percentile) m/s^2	Recommended initial value (75th percentile) m/s^2
100 – 180mm [4 to 7”]	Vibration values will depend on force being applied and different materials being worked. Selecting the right grade of abrasive and applying the right forces can help to minimise exposures	3	10	7
125 and 100mm Flapper discs [4 to 5” Flap discs]		2	5	4
220 – 300mm [8.6 to 11.8”]	Vibration values can vary across the many sub-categories and different materials being worked. Applying too much force can produce lobing of the discs and significantly increase vibration levels	4	11	9

Reliable & Established Databases

3.6 Database – Vibration

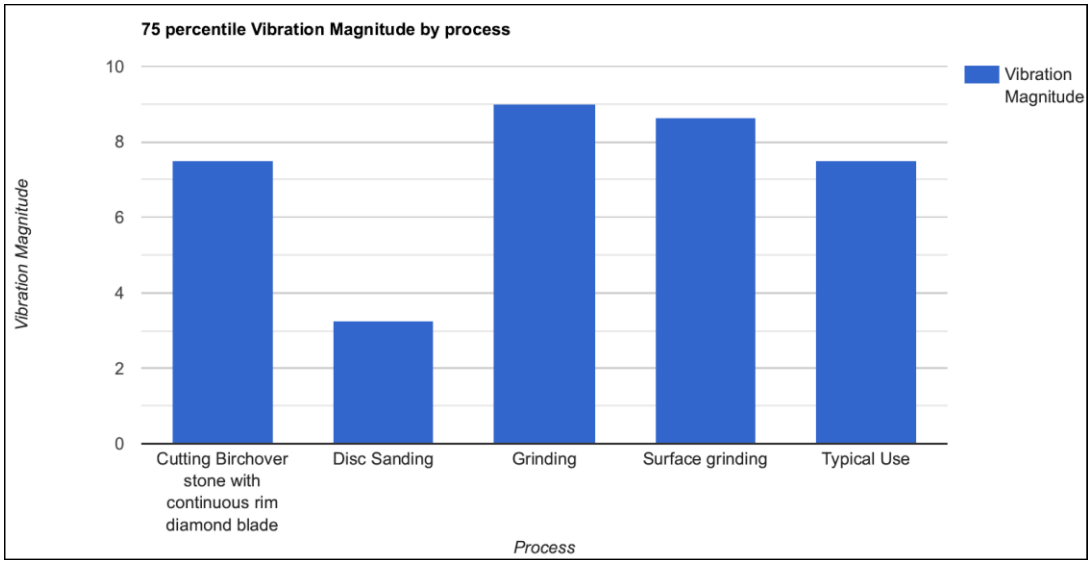
Source – The Tool Advisor [https://www.thetooladvisor.com/]
Device Filter – Makita GA4530R and similar tool, Makita 9554NBKD

Example Grinder A – Makita GA4530R 115mm Angle Grinder
Example Grinder B – Makita 9554NBKD 115mm Angle Grinder [similar]

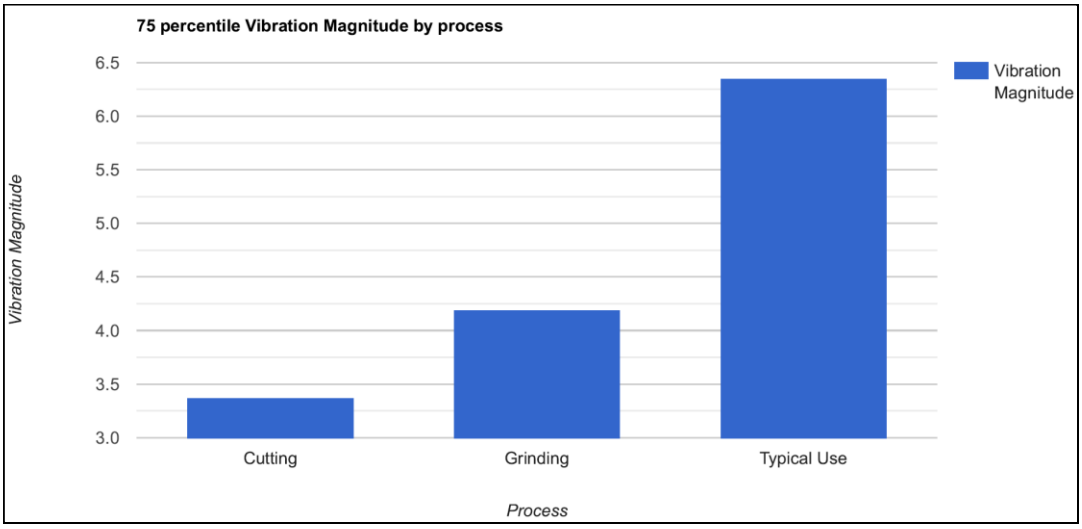
Summary of Results

Activity	75th percentile Vibration m/s²	
	Grinder 1	Grinder 2
Cutting birchover stone / diamond blade	7.5	-
Cutting	-	3.4
Disc sanding	3.3	-
Grinding	9	4.2
Surface grinding	8.6	-
Typical use	7.5	6.4

Example Grinder A – Tool Advisor Data - Makita GA4530R 115mm Angle Grinder



Example Grinder B – Tool Advisor Data – Makita 9554NBKD 115mm Angle Grinder



3.7 Measured Data – Vibration

Sample Tool Vibration Magnitudes Measured on Site Visit by ASL

Tool	Consumable	Vibration magnitude m/s^2
Bosch 5” Angle Grinder Normal & Anti-Vibration Handle*	Sanding Disc Cubitron	6.8
Bosch 5” Angle Grinder	Cutting/Grinding Disc Cubitron	4.7
Bosch 5” Angle Grinder	Cutting/Grinding Disc Vulcan Norton	8.3
Bosch 5” Angel Grinder	Flap Disc Abracs	5.6
Kobe Die Grinder	Sandpaper	3.7
Bosch 9” Angle Grinder	Cutting/Grinding Disc Cubitron	5.2

* Peak vibration on rear handle – reduced vibration on front only [anti-vibration handle only]
Note: Variation in result with consumable