

Occupational Exposure to Mechanical Vibration: The Italian Vibration Database for Risk Assessment

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The Italian vibration database is presented. It is hosted by a web server at the National Institute of Occupational Prevention and Safety (ISPESL) in Rome, Italy (<http://www.ispesl.it/vibrationdatabase>). It supports in risk assessment employers who have to comply with Legislative Decree 187/05, now replaced by Legislative Decree 81/08, which transposes into law Vibration Directive 2002/44/EC. The database currently contains measurements and EC-declared values from over 980 hand-held power tools (such as pneumatic and electric hammers, chainsaws, grinders, drills, sanders and saws) and from over 420 vehicles (such as buses, forklifts and wheel tractors). The database is continuously updated as soon as new experimental and declared data are acquired.

hand–arm vibration whole–body vibration risk assessment vibration database

1. INTRODUCTION

Despite a decline in the proportion of the workforce employed in traditional, physically demanding sectors such as manufacturing, construction, agriculture and mining, some physical risks such as mechanical vibration and noise are still prevalent. It has been estimated that a total of ~24% of European workers are exposed to mechanical vibration, and the trend

has shown a slight increase since 1990 [1]. About 26% of Italian workers, i.e., over 5 million people, are exposed to potentially harmful mechanical vibration at the workplace; 11% are exposed all the working time, 8% at least three quarters of the time and 7% at least one quarter of the time.

There is strong epidemiological evidence of a relationship between occupational exposure to hand–arm vibration (HAV) and a number of health effects and injuries referred to as the

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hand–arm vibration syndrome (HAVS). There is also epidemiological evidence of a relationship between occupational exposure to whole–body vibration (WBV) and a number of health effects and injuries of the spine. Despite this evidence, the Italian Workers' Compensation Authority (INAIL) until recently recognised and compensated only for vascular and musculoskeletal disorders of the hand–arm system and the carpal tunnel syndrome. At present mechanical vibration is the fifth most common occupational disease compensated for in Italy.

After European Union Directive 2002/44/EC [2] was issued, the Italian government implemented it with Legislative Decree 187/05, the first Italian regulation specifically dedicated to occupational exposure to mechanical vibration. It came fully into force on January 1, 2006. It has now been replaced by Legislative Decree 81/08 [3]. According to this law, employers have to implement a programme of prevention and reduction measures in the workplace. In particular, they need to assess the level of mechanical vibration to which workers are exposed and, if necessary, measure that level with special apparatus and appropriate methodologies. On the basis of that risk assessment, the employer should determine what measures to take according to legal obligations: worker information and training, health surveillance and/or provisions aimed at avoiding or reducing exposure.

Even though mechanical vibration is a traditional physical risk factor, in Italy there are no competent services or technicians able to assess and measure the level of mechanical vibration to which workers are exposed. Hence, Legislative Decree 81/08 allows employers to use as sources of information on the magnitude of vibration manufacturers' emission data and national databases established by the National Institute of Occupational Prevention and Safety (ISPESL) and the Regions. At present, there is only the ISPESL database, which has become the centralised Italian database to support Legislative Decree 81/08 for risk assessment purposes.

The idea of this database originated during the Vibration Injury Network research project (1999–2001), supported by the European Commission under the BIOMED 2 programme. Two Italian

partners were involved: ISPESL and the Local Health Service of Siena. The format of this database fulfils the following requirements:

- data are presented in a clear, understandable and useful way;
- the database is easily accessible by a large number of users (in the first year ~200000 visitors accessed the database);
- measurement data pass through quality control before insertion;
- data are based on measurements conducted in accordance with European Committee for Standardization (CEN) or International Organization for Standardization (ISO) standards;
- new data inserted in the database are quickly accessible for users;
- corrections and additions are easy to introduce;
- the database is easy to manage and maintain.

The aim of the database is also to advise employers on the choice and purchase of work equipment of appropriate design producing the least possible vibration transmitted to the hand–arm system and to the whole body, in compliance with Article 5 of European Directive 2002/44/EC [2]. In fact this article, among the technical and/or organisational measures intended to reduce to a minimum exposure to mechanical vibration and the attendant risks, states that the employer takes into account in particular “the choice of appropriate work equipment of appropriate ergonomic design and, taking account of the work to be done, producing the least possible vibration”.

2. DATABASE CONTENT

The database currently contains measured data (collected by ISPESL and the Local Health Service of Siena) and EC-declared values relative to over 980 hand-held power tools (such as pneumatic and electric hammers, chainsaws, grinders, drills, sanders and saws) and from over 420 vehicles (such as buses, forklifts and wheel tractors). After loading the homepage (Figure 1), the reader is directed to the User Guide to the Vibration Database, which has to be read and accepted.



Welcome to the ISPEL Vibration Database

This Vibration Database is compliant with Legislative Decree No. 81 of April 30, 2008 (Article 202, paragraph 2; Annex XXXV).

ISPEL declines any responsibility due to incorrect use of data and information included in this Vibration Database.

To access the database, users should refer to the "[User guide to the Vibration Database](#)" and accept its content.

ISPEL - Vibrations Database - Last update: September 2008 [Contact us](#) | [Web Design and Content](#)

Figure 1. Homepage of the National Institute of Occupational Prevention and Safety (ISPEL) vibration database.



Summary of existing data
 Last update: **September 2008**
 Number of vehicles: **421** Number of measurement: **959**
 Number of tools: **981** Number of measurement: **497**

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Figure 2. Entrance menu of the database.

The guide helps the user to use the database properly; instructions should be followed carefully as assessment of exposure to vibration with databases is a delicate and difficult task for which measurement remains the reference method. The guide also instructs the user how to properly manage manufacturers' vibration emission values

declared according to Machinery Directive 98/37/EC [4]. They are reported in instruction handbooks of hand-held power tools and hand-guided machines or other publications; they are used to determine daily exposure $A(8)$ according to the recommendations in Technical Report CEN/TR 15350:2006 [5]. In fact, for some families



Your path: ISPEL / Documentazione / Vibrations Database / HAV / Tools list

[Home BDV] User Guide | HAV (List of tools) | WBV (List of vehicles) | References Tables | Bibliography | Links [It] [En]

Hand Arm Vibrations (HAV)

Menu	Manufacturer	Model	Values				
Search Complete list Browse Back Next [01] [02] [03] [04] [05] [06] [07] [08] [09] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] [45] [46] [47] [48] [49] [50] [51] [52] [53] [54] [55] [56] [57] [58] [59] [60] [61] [62] [63] [64] [65] [66] [67] [68] [69] [70] [71] [72] [73] [74] [75] [76] [77] [78] [79] [80] [81] [82] [83] [84] [85] [86] [87] [88] [89] [90] [91] [92] [93] [94] [95] [96] [97] [98] [99] [00] [01] [02] [03] [04] [05] [06] [07] [08] [09] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] [45] [46] [47] [48] [49] [50] [51] [52] [53] [54] [55] [56] [57] [58] [59] [60] [61] [62] [63] [64] [65] [66] [67] [68] [69] [70] [71] [72] [73] [74] [75] [76] [77] [78] [79] [80] [81] [82] [83] [84] [85] [86] [87] [88] [89] [90] [91] [92] [93] [94] [95] [96] [97]	STIHL	046	Declared value		Maximum measured value		
				a(w) sum	A(8) 1-8h	a(w) sum	A(8) 1-8h
				5,4	■■■■■■■■■■	5,9	■■■■■■■■■■
				Declared value		Maximum measured value	
				a(w) sum	A(8) 1-8h	a(w) sum	A(8) 1-8h
						9,6	■■■■■■■■■■
			Declared value		Maximum measured value		
			a(w) sum	A(8) 1-8h	a(w) sum	A(8) 1-8h	
					6,3	■■■■■■■■■■	
			Declared value		Maximum measured value		
			a(w) sum	A(8) 1-8h	a(w) sum	A(8) 1-8h	
			4,5	■■■■■■■■■■	6	■■■■■■■■■■	
			Declared value		Maximum measured value		
			a(w) sum	A(8) 1-8h	a(w) sum	A(8) 1-8h	
			7,3	■■■■■■■■■■			

Key
 ■ <2,5 m/sec² ■ =>2,5 m/sec² e <5 m/sec² ■ =>5 m/sec²

Figure 3. The hand–arm vibration database, a sample browse page.

of machines the total value of vibration a_{hv} can be estimated with a correction factor c to be multiplied by the declared vibration data.

At the end, the guide directs the user to effective field reductions of antivibration gloves, when they are used as personal protective equipment to reduce exposure to hand–arm vibration. In fact, those gloves, which have to be CE marked and certified according to Standard No. EN ISO 10819:1996 [6], show values of effective reduction measured in the field ranging from a minimum of under 10% for percussion tools to a maximum of 60% for some rotatory tools. At that point the reader is allowed to access

the database, and a tool bar menu can be activated (Figure 2).

If, e.g., the HAV button is picked, readers enter a search menu where the first item (Search) allows them to search the tool database with a number of filters that can be activated. The second item (Complete list) allows them to browse through the tool list page by page (Figure 3). Each page reports a list of tools identified by tool category, constructor and model and the EC-declared value; the maximum value measured in the field is reported. When a tool has been found, a complete data sheet is available by clicking on the instrument’s active link; the



Your path: [ISPESL](#) / [Documentazione](#) / [Vibrations Database](#) / [WBV](#) / [WBV \(List of vehicles\)](#)

[\[Home BDV\]](#) | [User Guide](#) | [HAV \(List of tools\)](#) | [WBV \(List of vehicles\)](#) | [References Tables](#) | [Bibliography](#) | [Links](#) | [\[It\]](#) | [\[En\]](#)

Whole Body Vibrations (WBV)

Menu

[Search](#)
[Complete list](#)

Browse

[Back](#) [Next](#)

[01]	[02]	[03]	[04]	[05]
[06]	[07]	[08]	[09]	[10]
[11]	[12]	[13]	[14]	[15]
[16]	[17]	[18]	[19]	[20]
[21]	[22]	[23]	[24]	[25]
[26]	[27]	[28]	[29]	[30]
[31]	[32]	[33]	[34]	[35]
[36]	[37]	[38]	[39]	[40]
[41]	[42]	[43]	[44]	[45]
[46]	[47]	[48]	[49]	[50]
[51]	[52]	[53]	[54]	[55]
[56]	[57]	[58]	[59]	[60]
[61]	[62]	[63]	[64]	[65]
[66]	[67]	[68]	[69]	[70]
[71]	[72]	[73]	[74]	[75]
[76]	[77]	[78]	[79]	[80]
[81]	[82]	[83]	[84]	[85]

Manufacturer	Model	Values	
Track-Type Tractor			
CATERPILLAR - CAT	D4 E	Declared value	Maximum measured value
		a(w)max A(8) 1-8h	a(w)max A(8) 1-8h
		0,92	■■■■■■■■■■
LANDINI	11500 C	Declared value	Maximum measured value
		a(w)max A(8) 1-8h	a(w)max A(8) 1-8h
		1,26	■■■■■■■■■■
FIAT AGRI	70 C	Declared value	Maximum measured value
		a(w)max A(8) 1-8h	a(w)max A(8) 1-8h
		0,98	■■■■■■■■■■
CATERPILLAR - CAT	D4D	Declared value	Maximum measured value
		a(w)max A(8) 1-8h	a(w)max A(8) 1-8h
		0,59	■■■■■■■■■■
FIAT AGRI	765 C	Declared value	Maximum measured value
		a(w)max A(8) 1-8h	a(w)max A(8) 1-8h
		0,3	■■■■■■■■■■

Key
 ■ <0,5 m/sec² ■ =>0,5 m/sec² e <1,0 m/sec² ■ =>1,0 m/sec²

Figure 4. The whole–body vibration database, a sample browse page.

sheet contains technical characteristics useful in risk assessment (e.g., a complete report of the manufacturer's information and a full report of all in-field measurements).

The EC-declared values in the database refer to manufacturers' emission data (according to Machinery Directive 98/37/EC), and those vibration magnitudes are measured in accordance with the corresponding parts of product standards (e.g., for power tools Standards No. EN ISO 8662-x and EN 28662-x [7]). In-field measurements refer to vibration measured during normal operation at a work site, according to Standards No. EN ISO 5349-1:2001 [8] and EN ISO 5349-2:2001 [9] for HAV, and Standard No. ISO 2631-1:1997 for WBV [10]. The HAV declared values and values measured in the field are reported in terms of the total value of root-mean-square (rms) frequency-weighted equivalent acceleration $a_{w(\text{sum})}$ and in terms of the daily exposure value normalised to an 8-hr reference period $A(8)$, as defined in Standard No. EN ISO 5349-1:2001 [8]. To help the user, the last parameter is calculated for exposure times ranging from 1 to 8 hrs per day.

The same procedure described for hand-held power tools holds for machines if the WBV button is picked in the entrance menu (Figure 2). Declared and measured WBV values are reported, where the highest rms value of frequency-weighted equivalent accelerations $a_{w(\text{max})}$ and the daily exposure value normalised to an 8-hr reference period $A(8)$ are given as defined in Standard No. ISO 2631-1:1997 [10]. In this case, the declared data available are poor as some categories of machineries are excluded from the scope of Machinery Directive 98/37/EC [4].

The database is still under construction. A new routine has been introduced; it enables manufacturers and private and public partners to submit EC-declared data and in-field experimental data to the database administrators. These data, after inspection by and approval from the database administrators, are transferred to the main database on the Internet. The database

is available in Italian and in English to allow international users to access it.

3. INTERNET LOCATION

The database is hosted by ISPESL's website in Rome, Italy¹. Over 450 000 users have consulted the database since the date of publication, December 1, 2005. Another two official European vibration databases are available on the Internet at present, the first hosted initially at the National Institute for Working Life and presently at Umeå University² in Sweden; the other is hosted on a web server of the Institute of Occupational Safety and Health (LIAA)³ in Postdam, Germany.

4. CONCLUSIONS

The database presented in this paper was initially developed by ISPESL in collaboration with the Department of Prevention of the Local Health Service in Siena, Italy. Now an agreement has been signed by ISPESL, the National Research Council (CNR) and the Technical Committee for Occupational Safety and Health of the Regions and the Autonomous Provinces to realise a unique Italian vibration database representative of all the main vibrating tools and machines used in the various working environments.

The goal is to equip the database with as many existing tools and vehicles as possible, and to update it so that it keeps up with the rapidly changing market; to this effect agreements have been signed with selected Italian public and private institutes in specific sectors (construction, boating, transportation, etc.) and INAIL, which also measures vibration exposure for compensation purposes. In this way they will have an opportunity to perform systematic and statistically representative measurements of the levels of mechanical vibration to which workers are exposed. The results of the measurements will be input into the national database (i.e., the only authorised one). A severe measurement protocol

¹ <http://www.ispesl.it/vibrationdatabase>

² <http://www.vibration.db.umu.se>

³ <http://www.las-bb.de/Karla>

has been established to fulfil this purpose, together with a format for data entry. Periodical round robin tests will be run by all participants to ensure the same quality levels and metrological standardisation of data delivered to the database by the various authorised subjects. The first external data have been recently delivered by an association of the Italian public and private transport companies (ASSTRA).

The decision of the Italian government to allow employers to use a vibration database for risk assessment purposes has created an intense debate, as risk assessment is a difficult and delicate task which has to be carried out by competent services or technicians, with a careful evaluation of workers' exposure to mechanical vibration produced by specific equipment used in the workplace in specific conditions of use. Among the Italian regulations on work, there has been only one precedent of using a database for risk assessment purposes; it concerned exposure to noise of construction workers (transposition of Directive 92/57/EEC on temporary or mobile construction sites [11]).

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