Prevenzione delle malattie da agenti fisici

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Physical agents at work: the state of the art

Despite a decline in the proportion of the workforce employed in traditional sectors such as manufacturing, construction, agriculture and mining, some physical risks such as noise and mechanical vibration are still largely prevalent(1).

Physical agents are responsible of more than 70% of the total professional diseases claimed for compensation in Italy, that are raising in recent years.

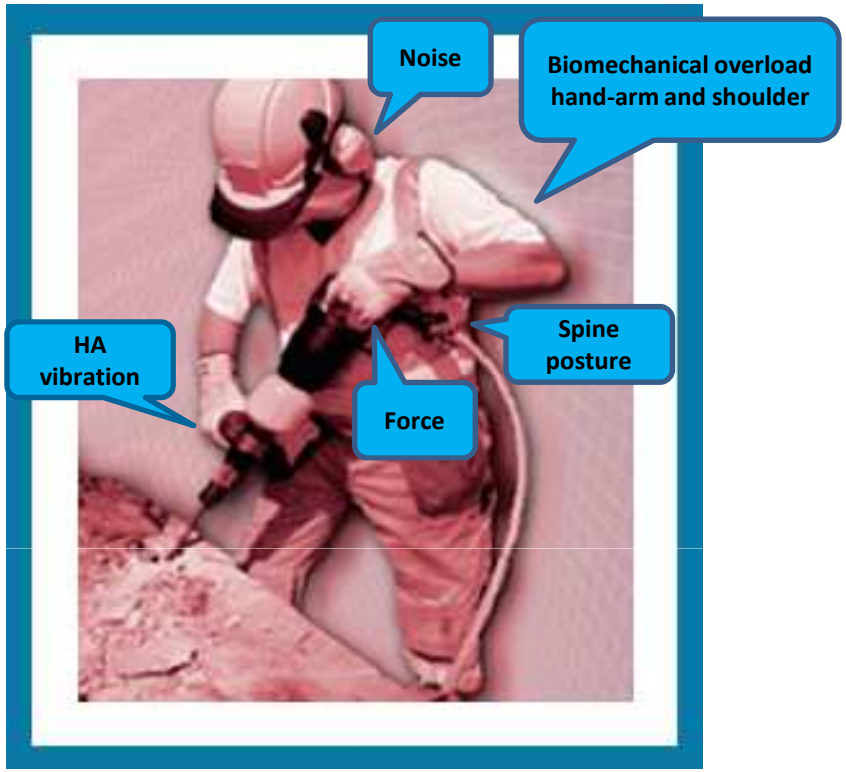
Intervertebral disc diseases is the first denounced disease (with more than 11.000 cases reported in 2011), tendinitis is the second, hearing loss is the third.

(1)Fifth European Survey on Working Conditions (Parent-Thirion et al., 2010)

Multiple exposure to physical agents with synergistic effects

Risk factors for the spine			
Risk factor	Strong evidence	Evidence	Low evidence
Handling/ Lifting	√		
Awkward postures		√	
Heavy work		√	
Vibration	√		
Static posture			√

Courtesy of Massimo Bovenzi



The image of the brochure is very instructive from the point of view of physical agents: the operator is exposed to noise, vibration, biomechanical overload of the arm and shoulder and postural stress of the spine, that act synergistically on the possible onset of osteo-articular and musculo-tendinous diseases, as well as on the emergence of hearing loss, hand-arm vibration syndrome (HAVS) and whole-body vibration injuries.

Why occupational diseases raise?

- The osteoarticular and musculoskeletal diseases in the new “table” of occupational diseases (D.M. 09/04/2008)
- “Multiple” denounces: a quarter of the 42,000 cases denounced in 2010 are multiple. E.g.: up to six complaints from hand-arm vibration exposure
- Noise, mechanical vibration and other physical agents fully regulated today from the italian legislation

Small and micro enterprises (SMEs) with up to 10 employees usually do not have internal H&S units and technicians able to measure physical agents at workplace; they amount to 90% of the total enterprises in Italy.

To help these employers to manage the physical risks, a new Italian experimental physical agents database has been developed.

It will be hosted by a web server at the Italian Workers' Compensation Authority (INAIL) in Rome, Italy. It will support the employers who have to comply with Legislative Decree 81/08 in risk assessment of physical agents such as noise (Noise Directive 2003/10/EC), mechanical vibration (Vibration Directive 2002/44/EC), electromagnetic fields (EMF Directive 2004/40/EC) and artificial optical radiations (AOR Directive 2006/25/EC).

The new database, developed jointly by the INAIL and the local Health Services of Siena and Modena, is available at the provisional web address: www.ispesl.it/vibrationdatabase, and it hosts measurements and EC-declared values of 2.400 machines and sources of physical agents.

It hosts the update of a previous vibration database, published in 2005, now closed. In fact, already in 2005 the employers had been admitted to use this database for risk assessment of mechanical vibration at work to comply with the obligations set by the Italian legislation.

By the end of march 2012 the new database hosts measurements and EC-declared values related to the physical agents noise, vibrations, electromagnetic fields and optical radiations, together with other useful tools and information such as software, guidelines, best practices, prevention and protection measures, FAQ, a review of normative and scientific references, helpful for risk assessment and control of physical agents at workplace.

For the equipment emitting physical agents, also specific standardized measurements protocols have been developed (harmonized with relevant ISO, CEN, CENELEC and CIE standards) and are available on site, in order to allow both the manufactures and occupational hygiene professionals to became data providers, contributing the data base with quality controlled data.

INAIL

PAF

PHYSICAL AGENTS PORTAL

PREVENTION AND SAFETY

N° OF MACHINES IN THE DATABASE **2.432** - N° OF MEASURES IN THE DATABASE **7.586**

Welcome to the Physical Agents Portal

Home page

Please, note that the portal is under construction and can be used for information purposes only. From March 2012 the Portal will be available in its final configuration.

The Physical Agents Portal (PAF) has been realised by the Prevention Department - Physical Agents Laboratory of the "USL 7 Siena" Health Agency in the frame of the "Targeted Plan for Risks arising from Physical Agents" approved by the Tuscany Region Committee Decree No. 5888 of 1 December 2008. The Portal has been developed in collaboration with INAIL (Italian Workers' Compensation Authority) and the Modena USL Health Agency in the framework of the Project of the Ministry of Health and of CCM (National Centre for disease prevention and control) "Risk arising from exposure to physical agents in working environments: development and adjustment of databases for supporting risk assessment and interventions for prevention in all working sectors" in order to provide an information tool which could direct the Security Managers and the Prevention Operators to a correct response for prevention and protection from PHYSICAL AGENTS. The user should look through the documents contained in the "Guide for using the Database" for each single Physical Agent in order to use the related data in the proper way. We decline any liability arising from an improper use of the data and information contained in the Databases and in the Portal.

www.portaleagentifisici.it

PAF

PAF > Hand-arm vibrations: machines: 1.416 measurements: 4.513

Hand-Arm Vibration Database

Brand All Model

Type All Power All

ADVANCED SEARCH SEARCH

HAV menu

1 2 3 4 5 6 7 Next


GRIZZLI
AMON
Type: Industrial vacuum cleaner **Power:** Electric 220V-380V


AIR TOOLS
04000
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic


AIRMARTIN
MW-5128V1
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic


ATLAS COPCO
EP6CMR 42/B
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic


ATLAS COPCO
LMS 17 - HR13
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic


ATLAS COPCO
LMS 22 - HR13
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic


ATLAS COPCO
LMS 37 - HR13
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic


ATLAS COPCO
LMS 57 - HR20
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic


ATLAS COPCO
LMS 64 - GR 25B
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic


ATLAS COPCO
LUM 21 HR23 - U
Type: Wrenches and screwdrivers (straight, pistolgrip an[...] **Power:** Pneumatic

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Machine technical sheet

Brand: ATLAS COPCO

Model: LMS 37 - HR13

Type: Avvitatori e cacciaviti (diritti, a pistola, angolari, ad impulso o a cricchetto)

Weight: 2.7 Kg

Power: Pneumatica

Anti-vibration devices: Assenti

Values declared in accordance to the standard **UNI EN ISO 8662-7:1999**
(x 1,5 Tightening bolts)

CONDITIONS	MATERIAL	ACCESSORY	VALUE	K (1)
NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	2.8 m/s^2	

(1) Additive coefficient

Field measurements

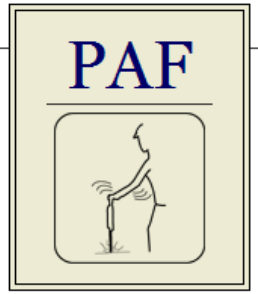
WORK ACTIVITY: BOLTING, UNBOLTING
WORKED MATERIAL: Metal alloys
ACCESSORY: NOT ASSESSED
SECTOR: Trains and tram materials

2.2 m/s^2

Reference person: Non Indicato ASSTRA - LeNORD (MI) (info@lenord.it)
Location: Interno reparto **on** 2006-01-01 NOTES: Fabbro treno

Values related to the vibration worst case handle (Left)

A_{hx} (Mean)	A_{hy} (Mean)	A_{hz} (Mean)	$A_{hv\ sum}$
1.5	**1.1** m/s^2	**0.7** m/s^2	**2** m/s^2
Mean **0.1** m/s^2	Standard deviation **0.1** m/s^2	Standard deviation **0.1** m/s^2	Standard deviation x 1,645: **0.16** m/s^2
Mean + Standard deviation: **1.6** m/s^2	Mean + Standard deviation: **1.2** m/s^2	Mean + Standard deviation: **0.8** m/s^2	$A_{hv\ sum}$ + (Dev. std. x 1,645): **2.2** m/s^2



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HAV -Calculating the level of exposure

Perform on-line calculation

Calculating the level of exposure

The current legislation establishes that the level of exposure to vibration shall be assessed by the calculation of the frequency-weighted equivalent acceleration value over an eight-hour reference period. This can be calculated by using the following formula:

$$A(8) = a_v \sqrt{\frac{T_e}{8}} \qquad (m/s^2) \quad (1)$$

where:

T_e : Total daily duration of vibration exposure (hours)

a_v Acceleration value resulting from the vectorial sum of the components measured on the orthogonal axes:

$$a_v\ (m/s^2) = (a^2_{wx} + a^2_{wy} + a^2_{wz})^{1/2}$$

If the worker is exposed to different vibration values, as in the case of the usage of several machines in a working day, the daily vibration exposure A(8) expressed as m/s2, will be calculated as follows:

$$A(8) = [\ \frac{1}{8} \sum_{i=1}^{N} a^2_{vi}\ \ T_i\ ]^{1/2} \qquad (m/s^2) \quad (5)$$

where:

a^2_{vi} : vectorial sum of the frequency-weighted acceleration for the i-th operation

T_i : Exposure duration for the i-th operation (hours)

Assessment of the risk for the hand-arm system

Rev. 3 - 10/11/2010

8 hours exposure to HAV (Hand Arm Vibration) A (8)				
n.	Type - brand - model	Vibration level ahv, eq m/s2	Daily working time in hours	Partial daily exposure A (8) m/s2
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Perform Calculation

Total time [hours]	A(8) m/s^2

HAV - Risk levels set by D.Lgs. 81/2008

$A(8) < 2{,}5\ m/s^2$

Risk assessment, no particular measures are requested

$2{,}5\ m/s^2 \leq A(8) \leq 5\ m/s^2$

Risk assessment, information and education, medical surveillance, program of technical measures to reduce the risk

$A(8) > 5\ m/s^2$

Forbidden, immediate measures to reduce the exposure below this value, like using tools with lower levels of vibration or reducing the exposure time

PAF

POSIZIONE: PAF > VIBRAZIONI MANO - BRACCIO > BANCA DATI

Hand-Arm Vibration Database

Brand: All Model:
Type: Martelli perforatori per Power: All
Measured value less than: 10
Declared value less than: 10
SORT BY VALUE: MEASURED DECLARED
SIMPLE SEARCH SEARCH

1 2 3 4 5 6 Next


HILTI
TE 104
Type: Rock drills and rotary hammers **Power:** Electric 220V-380V


METABO
UHE 28
Type: Rock drills and rotary hammers **Power:** Electric 220V-380V


MAKITA
HR 3000 C
Type: Rock drills and rotary hammers **Power:** Electric 220V-380V


HITACHI
DH24PB2
Type: Rock drills and rotary hammers **Power:** Electric 220V-380V


AIRMATIC
MP1
Type: Rock drills and rotary hammers **Power:** Pneumatic


SPIT
335
Type: Rock drills and rotary hammers **Power:** Electric 220V-380V

The database enables to look for ergonomic tools

PAF

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Machine technical sheet

Brand: HILTI

Model: TE 104

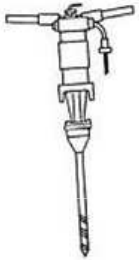
Type: Martelli perforatori per lapidei e martelli rotativi

Weight: 3.5 Kg

Power: 550 W

Power: Elettrica 220V-380V

Anti-vibration devices: Assenti



Values declared in accordance to the standard **EN 50144-2-6**
(x 2,0 Hammer drilling, Chiseling, Drilling without impact - x 1,5 Breaking concrete/masonry)

CONDITIONS	MATERIAL	ACCESSORY	VALUE	K(1)
NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	9 m/s^2	

(1) Additive coefficient

Field measurements

WORK ACTIVITY: DEMOLITION WORKED MATERIAL: Stone ACCESSORY: Bit (nail, spike) SECTOR: Building constructions	10 m/s^2
WORK ACTIVITY: DEMOLITION WORKED MATERIAL: Stone ACCESSORY: Bit (nail, spike) SECTOR: Building constructions	6.8 m/s^2
WORK ACTIVITY: DEMOLITION WORKED MATERIAL: Concrete ACCESSORY: Chisel SECTOR: Building constructions	9.3 m/s^2
WORK ACTIVITY: DEMOLITION WORKED MATERIAL: Dry building mortars ACCESSORY: Chisel SECTOR: Building constructions	8.9 m/s^2

PAF

PAF > Whole body vibrations: machines: 995 measurements: 3.093

Whole-Body vibration Database

Brand [All] Model [ ]

Type [Wheel excavator (18)] Power [All]

ADVANCED SEARCH SEARCH

WBV menu

1 2 Next


CASE
WX145
Type: Wheel excavator **Power:** Internal combustion diesel engine


CATERPILLAR - CAT
M 315
Type: Wheel excavator **Power:** Internal combustion diesel engine


FAI
1100
Type: Wheel excavator **Power:** Internal combustion diesel engine


FIAT KOBELCO
E175W
Type: Wheel excavator **Power:** Internal combustion diesel engine


FIAT-ALLIS
FE 18R
Type: Wheel excavator **Power:** Internal combustion diesel engine


FIAT-HITACHI
FH 120W
Type: Wheel excavator **Power:** Internal combustion diesel engine


FIAT-HITACHI
FH 150W
Type: Wheel excavator **Power:** Internal combustion diesel engine


KOMATSU
PW 170ES
Type: Wheel excavator **Power:** Internal combustion diesel engine

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Machine technical sheet

Brand: FIAT-ALLIS

Model: FE 18R

Type: Wheel excavator

Power: Internal combustion diesel engine

Values declared in accordance to the standard **UNI EN 7096:2009**

CONDITIONS	MATERIAL	K(1)
No declared data		

(1) Additive coefficient

Field measurements

WORK ACTIVITY: LOADING/UNLOADING Features of the work activity (in ITALIAN): Caricamento terreno su autocarro SECTOR: Building constructions ACCESSORY: Bucket Features of the accessory (in ITALIAN): Benna da 0,30 mc	0.5 m/s^2
WORK ACTIVITY: DEMOLITION Features of the work activity (in ITALIAN): Demolizione blocco in cls SECTOR: Building constructions ACCESSORY: Hydraulic hammer Features of the accessory (in ITALIAN): Martellone Montalbert 501	1.1 m/s^2
WORK ACTIVITY: EXCAVATION Features of the work activity (in ITALIAN): Scavo a sezione obbligata con mezzo stabilizzato SECTOR: Building constructions ACCESSORY: Bucket Features of the accessory (in ITALIAN): Benna da 0,30 mc	0.4 m/s^2
WORK ACTIVITY: EXCAVATION Features of the work activity (in ITALIAN): Scavo a sezione obbligata con mezzo stabilizzato SECTOR: Building constructions ACCESSORY: Bucket Features of the accessory (in ITALIAN): Benna 0,9 mc	0.6 m/s^2

WBV - Risk levels set by D.Lgs. 81/2008

$A(8) < 0{,}5\ m/s^2$

Risk assessment, no particular measures are requested

$0{,}5\ m/s^2 \leq A(8) \leq 1{,}0\ m/s^2$

Risk assessment, information and education, medical surveillance, program of technical measures to reduce the risk

$A(8) > 1{,}0\ m/s^2$

Forbidden, immediate measures to reduce the exposure below this value, like using tools with lower levels of vibration or reducing the exposure time

CONCLUSIONS AND FUTURE WORK

- The database will be continuously updated and implemented with new data and information
- The database is already accessed by more than 12,000 visitors per month (10% from foreign countries)
- Complete english translation
- Add more data (declared and measured), especially for EMF and AOR (at present, respectively, 45 and 36 sources)
- Support standardized procedures for assessing risks from physical agents in SMEs
- Add other physical agents such as infrasounds, ultrasounds, hyperbaric atmospheres and microclimate

Thank you for your attention!