

**HAND ARM
VIBRATION**



International conference
6-9 JUNE 2023
Espace Prouvé,
Nancy, France

Zero Vibration Injury — A Swedish Holistic Approach to Reduce Vibration Injury

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Outline

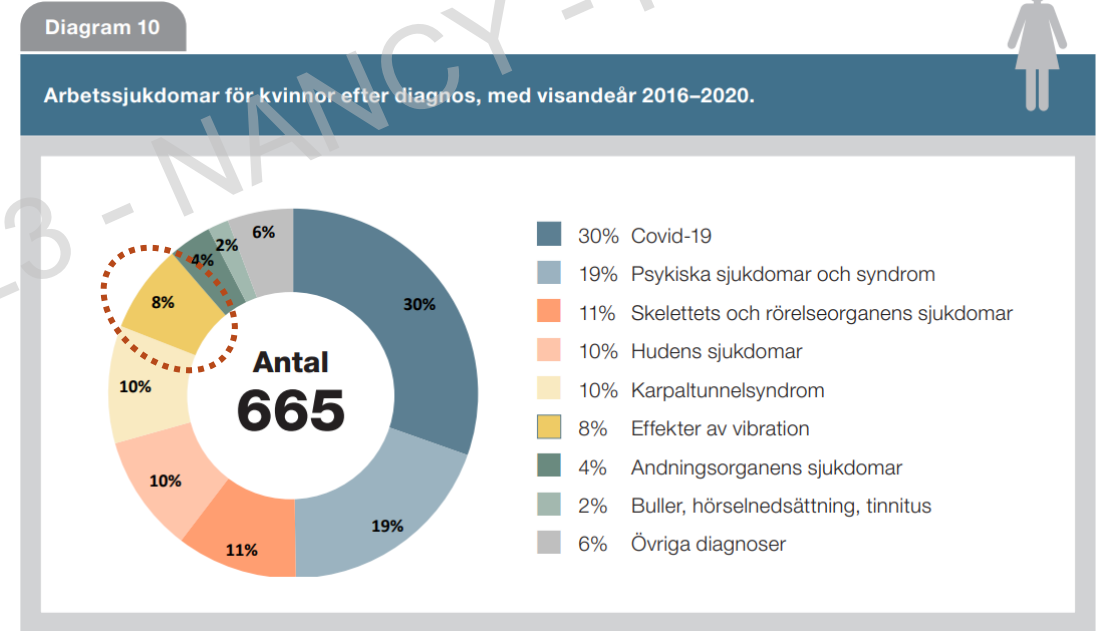
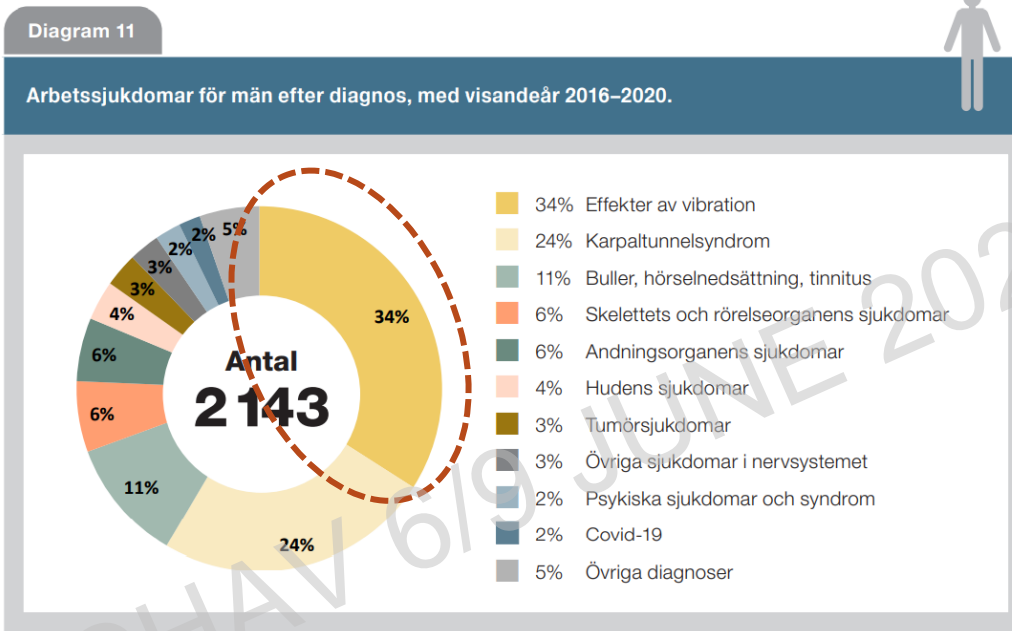
- Background
- Introduction to the project
- Results
- ZeroVibCenter

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Vibration injury in Sweden, AFA Workplace injury report 2022

Approved occupational diseases with between the years 2016 to 2020



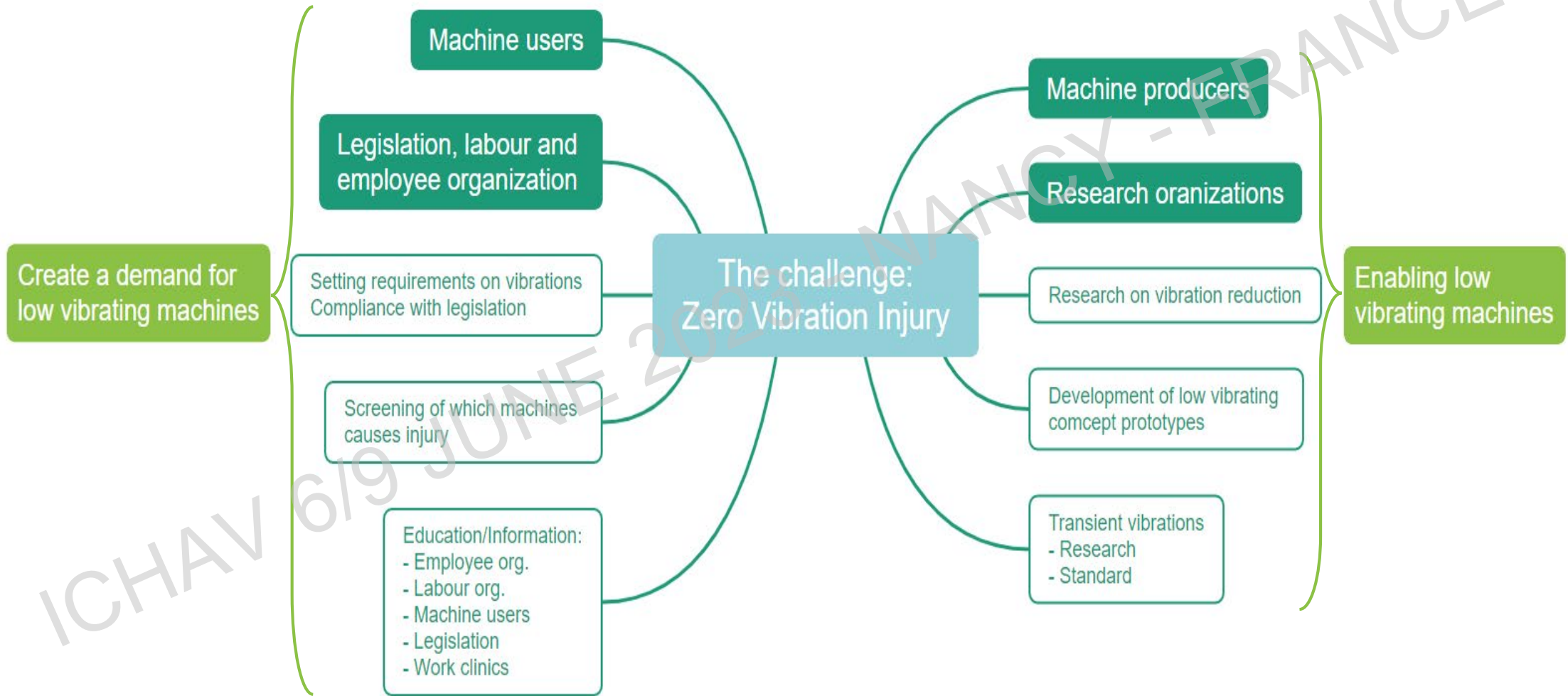
In Sweden 400 000 persons are exposed to vibrations more than 2 hours per day.

The project: Zero Vibration Injury

- Duration 2014-2024
- Financed by Sweden's innovation agency Vinnova and the participating companies
- Goal: eliminate vibration injury by addressing the source of the problem by developing low-vibration machines
- **Machines do not need to vibrate and injure people!**
- Activities in this stage, e.g.:
 - Scale up from concept prototypes to machines made available on the market
 - Development of RVM10 measurement system (ISO-5349-1 and ultravibrations)



The challenge



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The holistic approach

- project members and reference group

Machine manufacturers



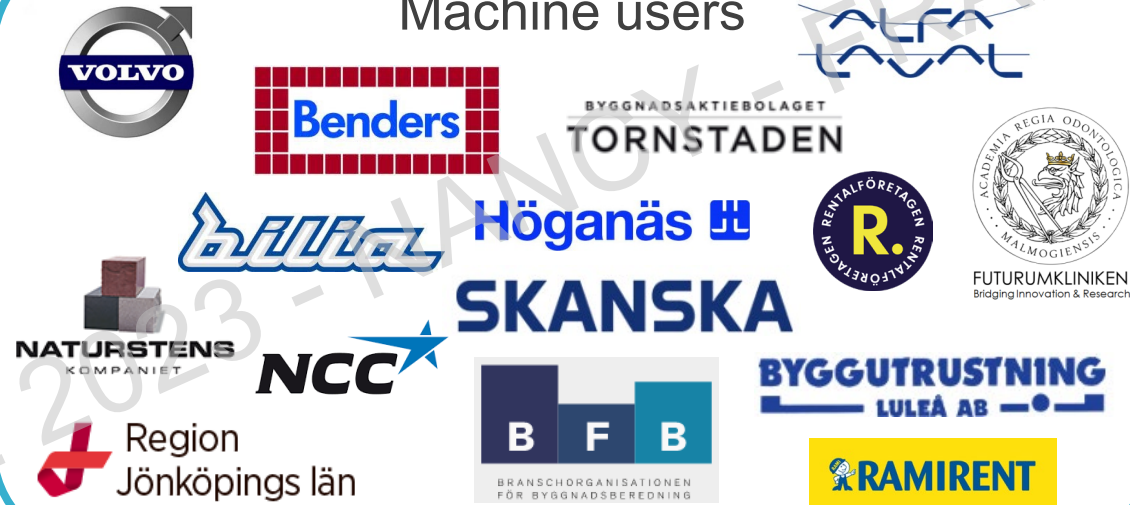
Researchers



Occupational health companies



Machine users



Legislation



Employee and labour organizations



Three stages of the project

1. It can be done!

Representative **prototype machine types** have been redesigned and tested in the laboratory.

2. It can be done in real production!

The solutions from stage one have been upscaled and set into industrial production in the relevant areas, i.e. **demonstrators**.

3. Make it happen!

The developed solutions will be implemented for the project participants, leading to the **manufacturing of low-vibration machines** as requested by the users, which results in lower vibration exposure and injuries.



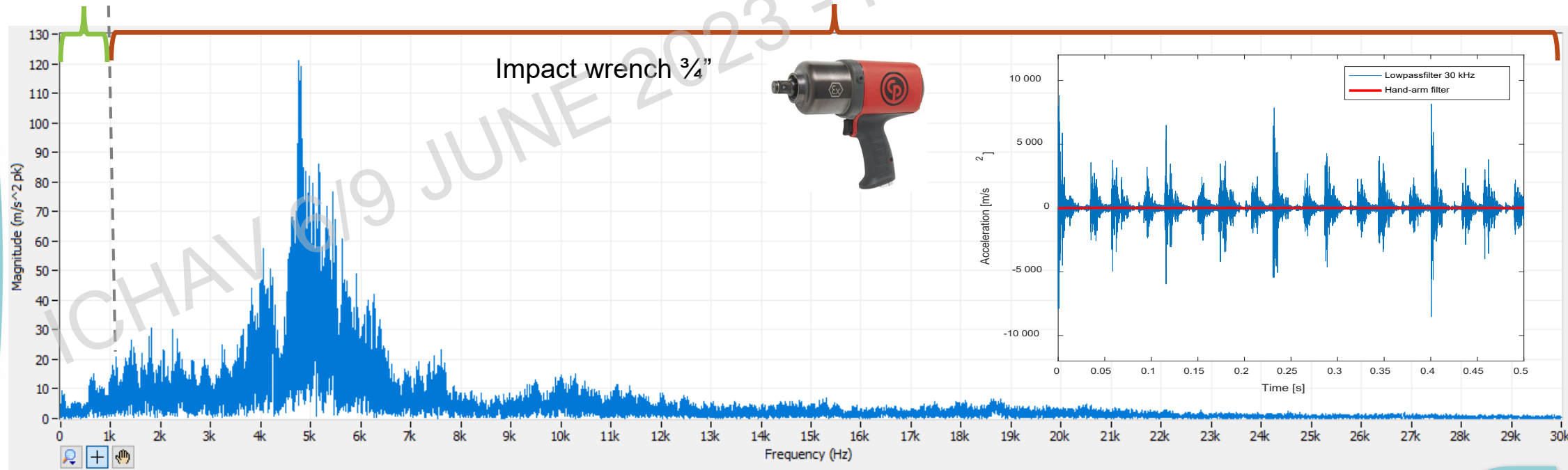
Vibrations, ISO 5349-1 vs. ultravibrations

< 1250 Hz = ISO 5349-1 vibrations → Regulated by legislation → **Ok!**

> 1250 Hz = High frequency vibrations/ultravibrations → Suspected to cause injuries → **The "Precautionary principle" should be used**

< 1250 Hz
Handled by ISO 5349-1

Ultravibrations
Precautionary principle

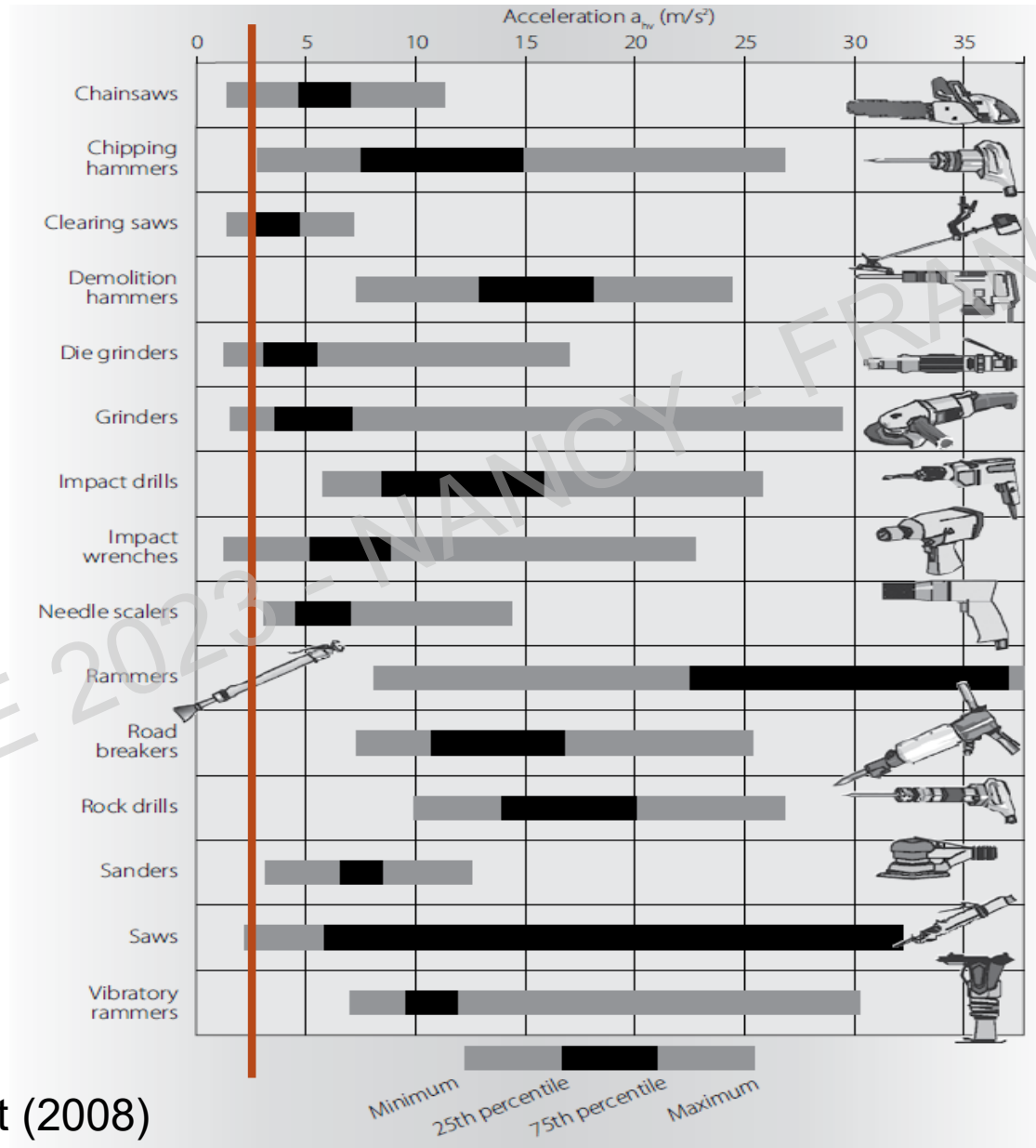


RVM10 measurement system

- Simultaneously measurement of ISO 5349-1 and ultravibrations (e.g. VPM value)
- Up to 50 kHz and 200 000 m/s²
- Sampling frequency, $f_c = 500$ kHz



What causes the vibrations?

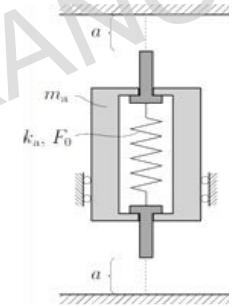


European Risk Observatory Report (2008)

Methods for reducing machine vibrations



Reciprocating vibrations:
Auto Tuning Vibration Absorber
(ATVA)



Rotating vibrations:
Balancing ring



Traditional vibration reduction technologies

- Vibration isolation
- New concepts



Results of some machines and tools within the project

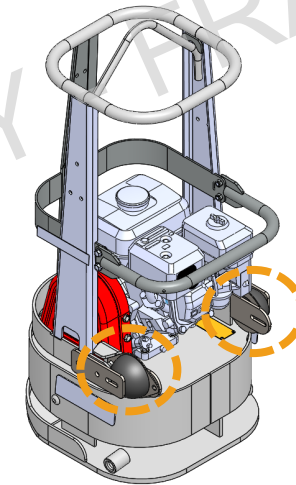


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Reduction in vibration levels of some machines in the project

Building and construction sector

Machine	Reduction method	Vibrations before (m/s ²)	Vibrations after (m/s ²)	Reduction
Round vibratory plate	Optimized vibration isolation	11.1	5.5	51%



Vibrations measured according to ISO 5349-1

Reduction in vibration levels of some machines in the project

Stone quarries

Machine	Reduction method	Vibrations before (m/s ²)	Vibrations after (m/s ²)	Reduction
Round vibratory plate	Optimized vibration isolation	11.1	5.5	51%
Chisel machine	ATVA, optimized vibration isolation	20	2.7	87%



Vibrations measured according to ISO 5349-1

Reduction in vibration levels of some machines in the project

Military (Swedish army)

Machine	Reduction method	Vibrations before (m/s ²)	Vibrations after (m/s ²)	Reduction
Round vibratory plate	Optimized vibration isolation	11.1	5.5	51%
Chisel machine	ATVA, optimized vibration isolation	20	2.7	87%
Rock drilling machine	Isolating handle	27.3	8.6	68%



Vibrations measured according to ISO 5349-1

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Rammer	ATVA, isolating handles	25–32	5-8	75–80%

Vibrations measured according to ISO 5349-1

Steel industry



Reduction in vibration levels of some machines in the project

Automotive and assembly

Machine	Reduction method	Vibrations before (m/s ²)	Vibrations after (m/s ²)	Reduction
Round vibratory plate	Optimized vibration isolation	11.1	5.5	51%
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Rock drilling machine	Isolating handle	27.3	8.6	68%
Rammer	ATVA, isolating handles	25–32	5–8	75–80%
Anvil	Vibration isolation	13 VPM: 8,000*	6 VPM: 150*	54% 98%



Vibrations measured according to ISO 5349-1

*Ultravibrations, VPM_{30kHz}

Machines do not need to vibrate
and injure people!



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ZeroVibCenter

- a meeting place for reduced vibration injury



- A Nordic network and meeting place for reducing vibration injuries

- Target: all companies and parties → → → → → → → → → →



Hosted by RISE

- Opinion formation
- Seminars, research projects, competitive intelligence...
- Participation in ISO/TC 108/SC 4/WG 3 "Human exposure to mechanical vibration and shock, Hand-transmitted vibration"
- Services:
 - Vibration measurement at companies
 - Vibration measurement of machines
 - Development of low vibrating machines
 - Discount on rental of RVM10
- [Zero vibration-related injuries Trailer](https://www.youtube.com/watch?v=58i9XTkQOss) (https://www.youtube.com/watch?v=58i9XTkQOss)



Thank you for your attention!

Merci de votre attention!

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Albin Almelin, detail

