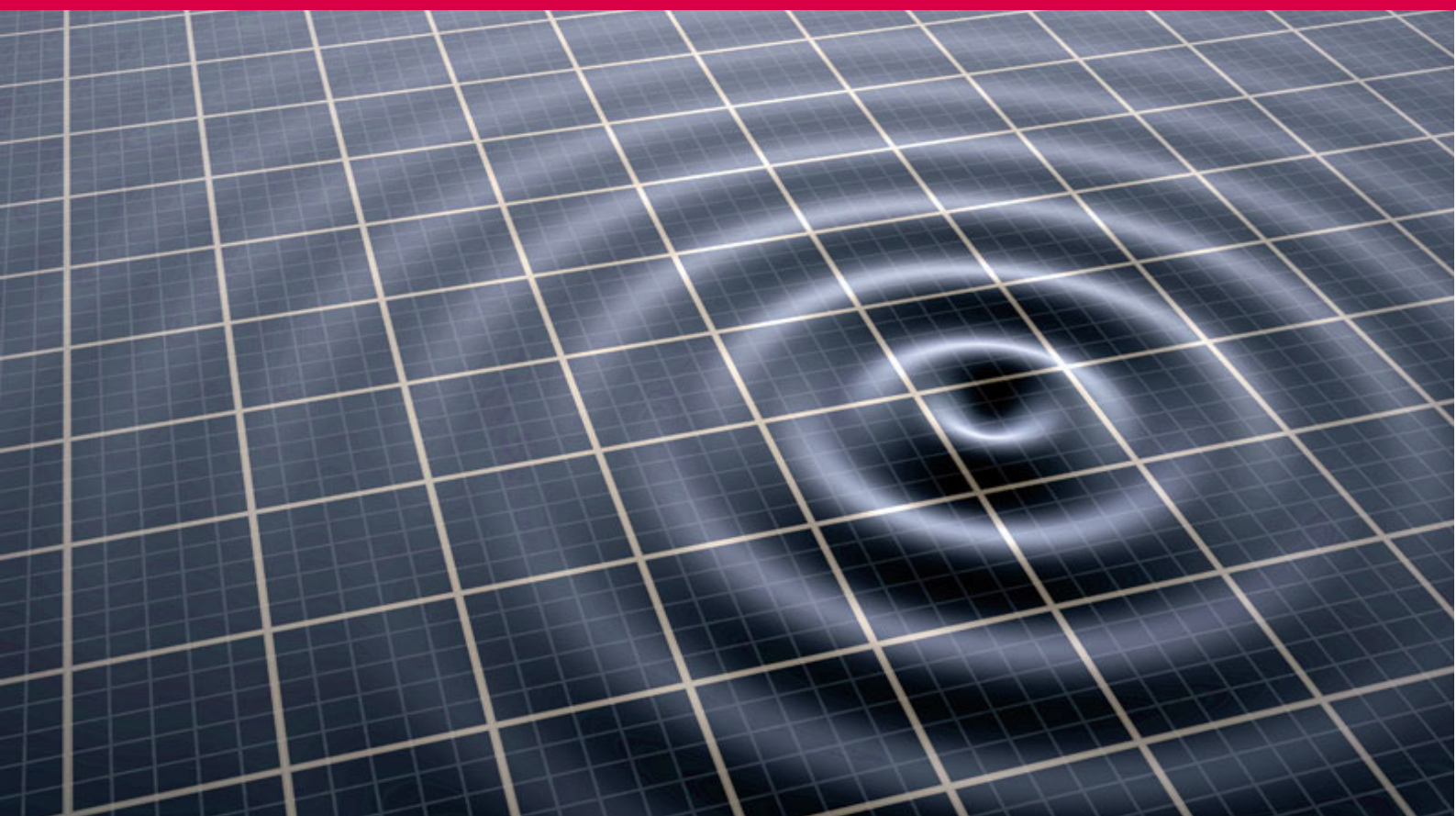


## Vibration testing in hand-held power tools

How to protect operators and improve the quality of equipment at the same time

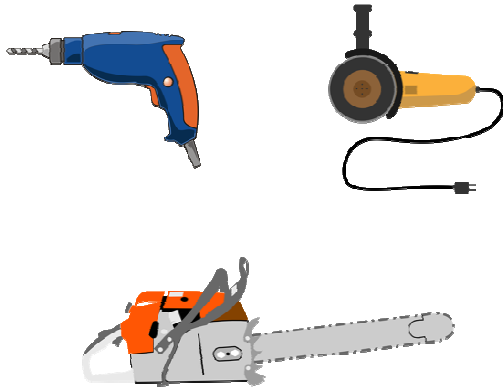


In the modern development of hand-held power tools, the measurement of frequencies and vibrations that can be harmful to humans, as well as determining resonances in rotating tools, plays an increasingly important role.

On the one hand, it is a matter of fulfilling the EU Standard “Noise and Vibration Regulations”. On the other hand, it is of great importance to identify weak points in the tool at an early stage by means of order tracking and thus eliminate them easily.

## Healthy power tools

In Germany, approximately 1.5 million people are regularly exposed to strong vibrations during their work due to hand-held power tools such as angle grinders, saws or drills.



Over time, these vibrations can lead to serious ailments, such as Raynaud's syndrome (white finger disease).

In order to avoid hand and arm vibrations leading to health disorders, the EU Standard "Noise and Vibration Regulations" was established to ensure that all employers determine and evaluate the risks to their employees when using hand-operated power tools, and where appropriate, make provisions.

## Development goals for hand-held power tools

Developers of innovative power tools have several goals in mind:

- A powerful and precise machine
- Minimization of vibrations and sound level according to EU Standard
- Make Standard-compliant characteristic values easily visible to employers so that they can comply with the Standard

## Implementation

### Standardized measurement method according to EN ISO 5349-1/2

This procedure is strictly in accordance with the EN ISO 5349-1/2. Here, a triaxial vibration measurement is carried out on the tool with acceleration sensors mounted close to the hand to simultaneously measure vibrations in all three orthogonal directions. These measurements focus on vibrations in the frequency range between 6.3 Hz to 1250 Hz, thus covering the range that is most sensitive to humans: 8 Hz to 16 Hz. With the help of a weighting filter for hand-arm vibration, the frequency-weighted RMS value is determined from the three triaxial channels. These values must conform to the ISO 5349 values set forth to protect against injury from the prolonged use of a power tool. The weighting filter is defined by means of appropriate imc STUDIO and imc FAMOS sequences. An "automated evaluation" then performs all further calculations in accordance with the Standard.

### System overview:

imc C-SERIES compact measurement device	Qty.
imc CS-3008-FD 8-channel ICP-measurement amplifier	1
imc CRONOS series modular system	
CRFX/2000 imc CRONOSflex base module with, e.g., module CRFX/ICPU2-8 8-channel ICP-measurement amplifier	1
imc AD – accelerometer	1
imc Software	
imc Online FAMOS Real-time data analysis platform for imc devices	
imc WAVE Comprehensive measurement software for sound and vibration analysis: measurement, visualization, automation, data analysis	
imc FAMOS Pro Data post-processing, analysis and visualization	

## Testing with imc

With its wide product range, imc offers manufacturers of electric tools a comprehensive solution from a single source.

### Hardware

The **imc CRONOSflex** modular measurement system provides the user an unprecedented degree of flexibility for configurations. The system does not require any racks or frames. Both the base unit and the modular measurement modules (amplifiers or conditioners) have independent housings: These can either be easily connected to a system by means of a robust “click” mechanism or alternatively used spatially distributed via a standard network cable. You can synchronously acquire various sensors and signals, analog and digital data, field buses, audio or video data.



Fig. 1: imc CRONOSflex

### Software

The powerful software platform **imc WAVE** is specialized in noise and vibration analysis through various analyzers. imc WAVE covers a wide range of applications, from acoustic testing on the road to structural analyses on the test bench to vibration testing on machines.

The software consists of three analyzers, each of which offers a holistic measurement approach:

#### Spectrum Analyzer

The Spectrum Analyzer offers professional tools for frequency analysis such as third-octave, octave and FFT spectra as well as

sound level evaluations according to EN 61672.

#### Order Tracking Analyzer

With the Order Tracking Analyzer, these frequency-dependent phenomena can be systematically correlated and investigated. Thus, FFT and order spectra can be analyzed as a function of speed and angle of rotation.

#### Structural Analyzer

The Structural Analyzer can be used to investigate structural dynamic problems in components such as noise and fatigue.

**imc WAVE** guides the user easily and safely through a Standard-compliant sound and vibration analysis with a target-oriented interface – from device configuration and microphone calibration to starting the measurement. The result is a professional evaluation according to Standards, without a user having to be an expert himself.



Fig. 2: imc Wave Spectrum Analyzer

## Conclusion

By using a combination of imc hardware and software, compliance with the specifications can be guaranteed on the one hand, and the efficiency of the devices can be increased on the other. In the process, Standard-compliant vibration measurement values are determined that customers need in order to comply with the EU Standard "Noise and Vibration Regulations". At the same time, the order tracking analysis of the vibrations makes it possible to evaluate the functional efficiency of the equipment and provides precise information on how to eliminate faults and make improvements.

## Additional Information:

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imc Test & Measurement GmbH is a manufacturer and solution provider of productive test and measurement systems. imc implements metrological solutions for research, development, service and production. imc has particular expertise in the design and production of turnkey electric motor test benches. Precisely outfitted sensor and telemetry systems complement our customer applications.

Our customers from the fields of automotive engineering, mechanical engineering, railway, aerospace and energy use imc measurement devices, software solutions and test stands to validate prototypes, optimize products, monitor processes and gain insights from measurement data. As a solution

provider, imc offers their customers an attractive and comprehensive range of services. These include project consulting, contracted measurements, data evaluation, specialist deployment, customer-specific software development and system integration. imc consistently pursues its claim of providing services for “productive testing”.

If you would like to find out more specific information about imc products or services in your particular location, or if you are interested in becoming an imc distributor yourself, please go to our website where you will find both a world-wide distributor list and more details about becoming an imc distributor yourself:

<http://www.imc-berlin.com/our-partners/>



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