

# Focus on IFA's work

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## Hand-arm vibration: risk analysis of oscillating knives

### Problem

The need for car windcreens to be removed arises both in automotive repair work and in the recycling of end-of-life vehicles. In the past, steel wire was used to separate the screen from the rubber seals. This method generated no vibration. In modern vehicles, including buses and coaches, however, the windscreen is generally bonded firmly to the rubber seal and the frame, for reasons of stability. The oscillating knives now used to remove windcreens, for example following damage to the glass, subject the user to a high level of vibration.

Owing to an increase in the reported cases of occupational disease, vibration measurements were performed under operational conditions for the purpose of hazard analysis and the development of preventive measures.

### Activities

Vibration was measured on pneumatic and electric power tools under typical working and operating conditions. The exposure parameter was measured in the form of the total vibration value  $a_{hv}$ , which is composed of the frequency-weighted accelerations in the three axes of measurement.

### Results and Application

Use of the oscillating knife requires the exertion of considerable force. Owing to the tool's size, the design of the handle is not ideal.



Use of an oscillating knife on a bus

The vibration exposure of the pneumatic tools studied is in the region of  $a_{hv} = 16.0$  to  $22 \text{ m/s}^2$ . After only six minutes per day, the lower exposure action value in accordance with the German OSH legislation governing noise and vibration, the LärmVibrationsArbSchV, may be reached.

Interaction between the rubber elements, the tool and the hand-arm system frequently gives rise to a resonance effect, as a result of which the vibration exposure may temporarily be even higher. At  $4.9 \text{ m/s}^2$  and  $10.9 \text{ m/s}^2$ , the manufacturer's data differ considerably from the value measured in practice, thereby presenting a risk of the hazard being underestimated.

On the electric tools, too, exposure levels in the region of  $a_{\text{hv}} = 6.6$  to  $21.4 \text{ m/s}^2$  were measured in practice.

Besides reduction by the tool manufacturers of the vibration emissions from oscillating knives, automotive manufacturers are also called upon to give consideration at the vehicle design stage to the exposure arising during repair and dismantling.

### Area of Application

Repair, automotive repair shops, design

### Additional Information

- Vibration exposure calculator for hand-arm vibration (in German)  
[www.dguv.de/webcode/d3245](http://www.dguv.de/webcode/d3245)
- DIN CEN/TR 15350; DIN SPEC 45694:2013-12: Mechanische Schwingungen - Anleitung zur Beurteilung der Belastung durch Hand-Arm-Schwingungen aus Angaben zu den benutzten Maschinen einschließlich Angaben von den Maschinenherstellern; Deutsche Fassung CEN/TR 15350:2013. Beuth, Berlin 2013

- Lärm- und Vibrations-Arbeitsschutzverordnung (LärmVibrationsArbSchV) vom 6. März 2007. BGBl. I (2007), S. 261-277
- Gesetz über die Durchführung von Maßnahmen des Arbeitsschutzes zur Verbesserung der Sicherheit und des Gesundheitsschutzes der Beschäftigten bei der Arbeit (Arbeitsschutzgesetz – ArbSchG) vom 7. August 1996. BGBl. I (1996), S. 1246-1253
- Kaulbars, U.: Technischer Vibrationsschutz bei Hand-Arm-Schwingungseinwirkung. Kennzahl 230 302. In: BGIA-Handbuch Sicherheit und Gesundheitsschutz am Arbeitsplatz. 34. Lfg. VI/1998. Hrsg.: Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (IFA), Sankt Augustin. Erich Schmidt, Berlin 1985 – Losebl.-Ausg.  
[www.ifa-handbuchdigital.de/230302](http://www.ifa-handbuchdigital.de/230302)
- Kaulbars, U.; Amari, M.: Strategien zur Reduzierung hoher Hand-Arm-Vibrationen am Beispiel von Oszillationsmessern. 5. VDI-Tagung Humanschwingungen, 28.-29. Mai 2013, Dresden – Vortrag. VDI-Berichte (2013) Nr. 2190, S. 363–374. Hrsg.: VDI-Verlag, Düsseldorf 2013  
[www.dguv.de/webcode/m338629](http://www.dguv.de/webcode/m338629)

### Expert Assistance

IFA, Division 4: Ergonomics – Physical environmental factors

### Literature Requests

IFA, Central Division