

# Focus on IFA's work

Edition 03/2019

617.0-IFA:617.81

## Analysis of the effectiveness of exoskeletons

### Problem

Exoskeletons have long been used successfully in medical rehabilitation, e.g. to enable paraplegics to walk again. In recent times, more and more exoskeletons have been coming onto the market specifically for use in commercial workplaces. Such systems are intended to mechanically assist workers engaged in strenuous activities such as lifting loads or working overhead.

Although numerous laboratory studies have already described isolated useful effects of exoskeletons, the actual benefit in industrial practice is still largely unknown. Firstly, it is not clear to what extent the postures tested in the laboratory really occur in practice in terms of their characteristics and duration. And, secondly, it is unknown whether and to what extent other necessary activities may be impaired by the exoskeleton.

### Activities

In cooperation with various social accident insurance institutions and the physical stressing unit of the DGUV Trade and Logistics Division, IFA tests different types of exoskeletons in the laboratory. On the basis of field measurements, it also advises social accident insurance institutions and their companies on the possible introduction of exoskeletons.



Experimental setup for testing exoskeletons in the laboratory  
Image: IFA

The laboratory investigations include biomechanical motion analysis including electromyography (EMG) of the exoskeletal effect in the mainly relevant activities and postures. Among the field measurements, precise activity profiles of the work shift are drawn up for all main and secondary activities. These allow the useful effect to be quantified over the course of the shift. In additional surveys, the subjectively perceived benefit is recorded along with any impairments caused by the exoskeleton.

## Results and Application

The results so far show that exoskeletons only provide a significant benefit when bending angles are well outside the neutral position. The effect of both passive and active exoskeletons is only supportive, i.e. they primarily (partially) compensate for the moving weight of the supported body segment. Additional loads must continue to be carried by the musculoskeletal system.

The use of exoskeletons at commercial workplaces must be thoroughly considered and usually requires competent assistance and advice from various disciplines. The new risk assessment to be produced for the workplace in connection with a particular exoskeleton also requires special care, as additional risks must be taken into account.

## Area of Application

Prevention services of the social accident insurance institutions, occupational health personnel, and occupational health & safety specialists

## Additional Information

- DIN EN ISO 13482: Robots and robotic devices – safety requirements for personal care robots. Beuth, Berlin, 2014
- Fachbereichs-Information: [Einsatz von Exoskeletten an gewerblichen Arbeitsplätzen](#). Ed. DGUV Fachbereich Handel und Logistik. Edition 02/2018
- Fach-Information Nr. 0059: [Einsatz von Exoskeletten an \(gewerblichen\) Arbeitsplätzen](#). Ed. Berufsgenossenschaft Holz und Metall. 11/2017
- Liedtke, M.; Glitsch, U.: Exoskelette – Verordnung für Persönliche Schutzausrüstungen. sicher ist sicher – Arbeitsschutz aktuell (2018) No. 3, pp. 110-113
- Schick, R.: Einsatz von Exoskeletten in der Arbeitswelt. Zbl. Arbeitsmed. 68 (2018) No. 5, pp. 266-269

## Expert Assistance

IFA Division 4: Ergonomics, physical environmental factors

## Literature Requests

IFA Central Division