

# Ergonomics in practice

## – Exoskeletons –

Exoskeletons are assistance systems worn on the body that support the human musculoskeletal system by absorbing or redistributing loads. They represent a new and currently very topical measure to support workplaces ergonomically – also in the food industry and in the hospitality sector. Exoskeletons are no panacea, but they can have a positive influence on ergonomic work.

### Information on the use of exoskeletons

#### How exoskeletons work

Depending on their design, exoskeletons support the upper extremities, the back or the legs, especially in unergonomic postures such as bending forward or working overhead. By absorbing or redirecting forces, premature fatigue and overstraining of particularly stressed areas of the body can be reduced. In addition, posture-improving effects can result.

All exoskeletons available on the market offer only partial support. The sole use of exoskeletons cannot necessarily eliminate the hazards of very unergonomic workplaces with high loads or repetitions.

#### Exoskeletons in the hierarchy of measures

Exoskeletons are personal measures. According to the hierarchy of measures (TOP), technical and organisational measures have

priority (e. g. height-adapted or height-adjustable workplaces, scissor lifts, vacuum lifters and other load manipulators).

#### Which workplaces are suitable?

Exoskeletons are particularly suitable as a supplementary measure at unergonomic workplaces where all technical adaptation possibilities have already been exhausted, and at non-stationary workplaces where technical measures are generally difficult to integrate. Furthermore, exoskeletons can transitionally be suitable at workplaces until technical aids are purchased.

#### Where exoskeletons can support

Exoskeletons support the human body almost exclusively during activities in unergonomic postures: e. g. repeated deep bending forward, prolonged working in a widely bent-forward posture or frequent and continuous working overhead.

At workplaces without these problems, e. g. due to an adapted working height, exoskeletons lose most of their supportive effect.

#### Can exoskeletons have negative effects?

In reality, there are always combinations of postures and movements, and most activities do not always take place in unergonomic postures. Because of this and the presence of secondary activities, the real supportive effect of exoskeletons can be less than expected.



Furthermore, exoskeletons cause additional stress for the wearer:

- additional weight must be carried on the body.
- the construction requires more space to avoid getting caught or tripping.
- movements may be restricted.
- additional work is required for putting on and taking off, stowing and cleaning.

In addition, body-worn equipment such as exoskeletons are subject to the subjective conditions and sensations of the person wearing them: for some they are a great support, others hardly notice anything or even feel impaired.

In this field of tension between support and additional burden, exoskeletons can thus also be rejected by the employees.

#### The right choice makes the difference

Whether and which exoskeleton is suitable for a workplace always depends on the general conditions: The effective types of stress, incurring movement patterns, repetitions and loads, space conditions, hygiene requirements, etc. The different types of exoskeletons also have their own advantages and disadvantages. Active exoskeletons, for example, tend to be larger, heavier and more expensive than passive exoskeletons due to their motor drives, but they offer the greatest support. But even skeletons that work according to the same principles sometimes differ noticeably. Therefore, try out several exoskeleton types and styles with the employees concerned and take their subjective perception into account. To be sure and to detect any disturbing effects, a skeleton should be tested for at least one to two weeks.



#### Introducing exoskeletons successfully

Before using an exoskeleton, the workplace-specific risk assessment must be expanded. Besides the proper activities, the spatial parameters (freedom of movement, aisles and escape routes), environmental influences (climatic conditions, temperature, humidity) and hazardous areas (chemicals, machine movements) must be taken into consideration.

Plan the introduction thoroughly and involve your employees. A high level of user acceptance is essential for long-term success of ergonomic measures. This is even more important with exoskeletons, as their use can be characterised by strong subjective and social perceptions (stigmatisation). Therefore, take individual characteristics of future users into account as well as the general company culture.

Analyse main and secondary activities at an early stage to determine which activities are supported by the skeleton and which possibly are impeded. Already a “frequent” dressing and undressing, e. g. to carry out an activity that lasts less than one hour can lead to acceptance problems.

An extensive testing phase which permanently involves the future users is indispensable for the selection of a suitable product. If the employees do not feel supported or uncomfortable when wearing it, the skeleton will not

be used or may be used incorrectly. Already during the testing phase occupational health support should be ensured and continue beyond. In this way, any long-term effects on health can be detected and eliminated at an early stage.

It is recommended to start with a low level of support and/or daily use and to increase this over the course of the first one to two weeks. This time is also needed to get used to the new work tool.



- **BGN Branchenwissen**  
<https://bgn-branchenwissen.de/ergonomie>
- **FBHL – SG Physische Belastungen der DGUV**  
[FAQ zum Thema Exoskelette](#)