

Position paper on the anthropometrics situation

With the request for approval and subsequent distribution by the NAERG Chairman to the parties stated

Basis:

Resolution 119 of the NA 023-00-03 Joint Working Committee taken at its 15th meeting on 21 October 2014:

The NA 023-00-03 Joint Working Committee asks the NAERG Advisory Council to describe the significance of anthropometrics and biomechanics and the critical situation in these areas (regarding personnel and training) to the German Federal Ministry of Labour and Social Affairs (BMAS).

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1. Objective

Products and workplaces can be of **safe and competitive** design only when the **anthropometric data** (see Annex 1) **used in their design is representative of the body dimensions in the population**. However, human physical characteristics have been changing **dramatically** in recent years, particularly with regard to the dimensions of **breadth, depth, girth and weight**. This gives rise to an urgent **need for action** by all parties responsible for safe products and workplaces. Only if the body dimensions used keep pace with this development can hazards to safety and health be prevented. The document **illustrates how dramatic the developments are** and describes the **steps that need to be taken**.

2. Parties involved

BMAS (Federal Ministry of Labour and Social Affairs)/BAuA (Federal Institute of Occupational Health)

BMBF (Federal Ministry of Education and Research)

BMG (Federal Ministry of Health)

BMWi (Federal Ministry for Economic Affairs and Energy)

DGUV (German Social Accident Insurance)

DIN/NAErg (German Institute for Standardization / Ergonomics Standards Committee)

German state ministries responsible for science and education

3. Consequences in practice of dramatic changes in body dimensions

Body dimensions are subject to **continual** change. In the past, this has always been taken into account by updating of the anthropometric data. Updates have primarily been prompted by **changes in the length dimensions** in recent decades. For the **dramatic changes in the breadth, depth, girth and weight dimensions** that we now face, however, the anthropometric data have not yet been updated. Up-to-date anthropometric data are therefore required. In major industrial enterprises (in the clothing and automotive industries), this observation has led to up-to-date data being surveyed and used. These data are however **not** available for public use (for example in the form of regulations or standards).

Consequently, **products** and **workplaces** can no longer be designed to be **safe and competitive**. This concerns not only technological innovations in manufacturing (industry 4.0) and new products, but also **traditional product safety and workplace design**.

Selected examples:

- **Access/passage openings:** A range of workplaces feature openings the dimensions of which are based upon human body dimensions. The EN 547-2 standard for example governs openings for whole body access at workplaces on machinery. The provisions of this standard are no longer consistent with current body dimensions.
- **Personal protective equipment (PPE):** The fit of PPE is generally important for the protection it provides. A failure to consider increases in the dimensions referred to results in loss of the PPE's protective action and suitability for use.
- **Important controls and actuators within reach:** The situating of controls and actuators (such as emergency-stop actuators or vehicle pedals) within reach is often dependent upon standard sitting or standing positions. These may no longer be possible when the breadth, depth

and/or girth dimensions have increased substantially (for example: a driver's seat that is moved backwards to accommodate greater abdominal girth, as a result of which the length of the legs, which has not increased, may no longer be sufficient for the pedals forward of the driver to be reached reliably)

- **Safety of work equipment** particularly in a **sitting position**: Here too, a failure to give consideration to the increase in the stated dimensions gives rise to problems. Standards such as that governing industry work chairs must not only consider the increase in weight with regard to the seats' load-bearing capacity, but must also adjust the seat surface area and allow for the changes in seat tipping characteristics when obese persons get up from the seat.
- **Dimensioning of escape and rescue routes**: The maximum dimension of the body girth to be considered for the dimensioning of escape routes has risen substantially in recent years. As a result, it can be assumed that the limits currently being applied are not adequate.
- Work in the **healthcare services/handling of patients**: Many findings (for example concerning lifting aids or the load-bearing capacity of rescue stretchers) are based upon outdated anthropometric data, as a result of which work equipment cannot be used safely or at all.

4. Issues

Short term: state financing of up-to-date, representative data

- **Representative surveys** of anthropometric data, with particular consideration of factors such as demographics and migration and of current studies (e.g. SHIP3 study, RKI Study DEGS1, project on the anthropometric data of children funded by the EU, national cohort)

Parties concerned: experts, co-ordination where appropriate by the BAuA, funding by the BMBF/BMAS/DGUV

Medium term: inclusion of the data in standards; updating of measurement methods

- Up-to-date data must be **interpreted** competently and made available to **standardization**
- For the purpose of **measurement**, integrative methods (digital and traditional) must be developed by which data can be made comparable and databases less cost-intensive
- **Adaptation of discrete measurement methods** that are no longer suitable owing to changes in the breadth, depth and girth dimensions

(persons to be measured are no longer able to assume standardized body postures owing to their high girth dimensions)

- Assurance of **continual updating** (monitoring) of changes in body dimensions
- Processing of the data with **particular consideration for the target group** (in a form conducive to easy comprehension and application, for example in product development or workplace design)

Parties concerned: experts, co-ordination where appropriate by the BAuA, funding by the BMBF/BMAS/DGUV

Long term: enhancing expertise

- **The numbers** of junior experts with anthropological/anthropometric training are currently **wholly inadequate**; this expertise must be assured now and on an ongoing basis, not least for work on standards committees
- **Promotion** of training in anthropometrics and industrial anthropology as part of (biology) **degree courses**; anthropology is now taught at only 7 locations in Germany, including at only one university with a focus upon current body dimensions, and with not a single dedicated chair. German academia **no longer** has a chair in **industrial anthropology**.
- **Inclusion of** tuition in biology/anthropology as a part of **technical degree courses**, to be provided by **properly trained personnel**

Parties concerned: German state ministries responsible for science and education

5. Conclusion

Political and financial support for the measures in the areas of action stated will assure that **the dramatic developments** referred to in the breadth, depth and girth dimensions are **appropriately addressed**. Only by this means will the availability of up-to-date data for the design of safe and healthy products and workplaces be assured.

Political support for the proposals and measures for improving the **situation in scientific training** and the acquisition of anthropometric skills is also required as a matter of urgency.

Annex 1: Significance of anthropometric data

The term "**anthropometrics**" is derived from the Greek words *anthropos* (human being) and *metron* (measurement). It describes the study and measurement of the physical dimensions and mass of the human body and of its (external) discrete elements (see also EN ISO 15535). Anthropometrics is thus the study of the measurement and application of human body dimensions.

A familiar **field of application** of anthropometric data is the **clothing industry**. Items of clothing must be adapted to body dimensions for reasons of either safety (as in the case of personal protective equipment) or fashion. In the course of the SizeGERMANY project, series of measurements were performed in 2007/2008 on well over 13,000 men, women and children. One objective was to optimize the stated sizes of clothing and, if possible, to harmonize them, at least throughout Europe. This study, financed by the private sector, addresses the fact that both average and individual body dimensions are **not static**, but change over time. Unfortunately, the data yielded by the study are not available for use in generic anthropometrics standards. Surveys of certain anthropometric data in Germany are also conducted by the Robert Koch Institute (RKI) for the purposes of health reporting. The scope of these data however falls well short of the objectives stated in the position paper.

The availability of comprehensive results would also be desirable in the area of standardization of **workplace and product design**, since anthropometric data constitute a substantial basis for the area of **ergonomics**, particularly for the dimensioning of workplaces, technical work equipment and consumer products. Such data are used for example in areas of **occupational safety and health**, for instance for the dimensioning of protective covers or clearances from hazardous parts. In the **design of workplaces**, these data serve as a basis for the determining of reaches and the formulation of requirements concerning standing and sitting workplaces. During the **design of technical work equipment and consumer products**, the dimensions of work chairs and desks are selected based upon these data, as are the dimensions of machinery. Anthropometric data are therefore contained directly or indirectly in many **standards** governing the **human-machine interface**, in order for the products which are to be designed in accordance with these standards to be dimensioned such that they are **safe and healthy**.

A number of **generic** European (EN)/international (ISO) standards governing anthropometric **methods** have recently been published. These standards, which adopt a methodical approach, constitute a first step; they are however still not universally used, although this is essential for the sake of global comparability of the surveyed body dimensions. With a small number of exceptions such as the EN ISO 7250 series of standards, "*Basic human body measurements for technological design*", **generic European and international standards** containing (up-to-date) anthropometric data on the desired scale are still lacking. Existing **national** standards do not fully plug this gap (DIN 33402-2, "*Ergonomics – Human body dimensions – Part 2: Values*" has not been updated since 2005) and are also of only limited suitability, particularly for the design of technical work equipment or consumer products traded on the European or world markets.

It remains a fact that **product standards** often refer to data that are **outdated** or of **uncertain origin**. Where certain user groups are not covered by these data, the consequence may be that products are not safe for these groups. Listing of such standards in accordance with the German Product Safety Act (ProdSG) would not therefore be possible.