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GB/T 44369-2024

Basic biomechanics measurements of human motion for technological design

用于技术设计的人体运动生物力学测量基础项目

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1.Structure and drafting rules for standardization documents" Drafting. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document is proposed and coordinated by the National Technical Committee on Ergonomics Standardization (SAC/TC7). This document was drafted by: China National Institute of Standardization, Northeast Normal University, Beijing University of Aeronautics and Astronautics, Sports Science Research Institute of the General Administration of Sport of China Institute, Beijing Union University, Beijing Sport University, Li Ning (China) Sporting Goods Co., Ltd., Beijing Jishuitan Hospital, Tsinghua University, Beijing Jin FA TECHNOLOGY CO., LTD. The main drafters of this document are. Zhang Xin, Hu Huimin, Xu Hongqi, Ran Linghua, Luo Ling, Zhou Qianxiang, Hao Weiya, Liu Zhongqi, Yang Aiping, Liu Hui, Yang Fan, Xiong Ge, Liu Jingmin, Zhao Qichao, Shi Jipeng, Liu Taijie, Wang Zhongting, Xue Yongtai.

Under the control of the central nervous system, the human body generates power through muscle contraction, pulling the bone lever to rotate with the joint as the pivot, thus achieving Industrial and agricultural production labor and daily life activities, etc. The biomechanical parameters of human motion are mainly composed of the kinematic parameters of joints and the dynamic parameters of muscles and bones. Mechanical parameters describe the various movements and working abilities of people. They are an important part of the basic data of human ergonomics and are widely used. For example, buttons, knobs, controls, and workspaces, work tasks, and the design of personal wearables and personal protective equipment. The design of the shape and operating force of controllers such as levers, steering wheels, pedals, handles, grips, switches, bottle caps, etc., living spaces, working spaces and maintenance spaces The layout of the workroom, control room, and vehicle cab, as well as the evaluation of lifting, carrying, pushing, and pulling loads, etc. There are significant differences among the population, which are affected by many factors such as age, gender, race, region, occupation, exercise habits, and obesity level. The biomechanical parameters of human motion are vectors, whose magnitude and direction are important and are affected by many factors such as posture, speed, duration and frequency. The range of motion of the joint is also related to the active and passive motion forms of the joint. Standardization is the basis for establishing a shareable human motion biomechanics

database. The differences in the definition of measurement items and measurement methods will lead to the inability to compare the biomechanical parameters of human motion measured by different groups. The database established by researchers is difficult to be used by other researchers and cannot be applied on a large scale to related technology design. Joints are the axis of human movement or rotation and play an important role in maintaining normal human activities. It should include the range of motion of the joints and how to achieve this range of motion. When the joints are within the comfortable range, people can continue to move for a long time. The dynamic quality and efficiency will be high, and its reliability and safety can be guaranteed. Position measurement of joint mobility is more in line with the needs of technical design. The force generated by the human body depends on the force of muscle contraction and the human body mechanical lever system with joints as rotation axes and long bones as levers. Only when the operating force does not exceed the user's physiological comfort range can the operation be safe, accurate and efficient, and will not cause any harm to the user's health. It is a common practice to measure static maximum strength to compare mechanical characteristics of different groups of people or to set force limits. In the form of static muscle contraction, the limbs are kept in a stable state, which can avoid the influence of joint movement on the measurement results, so it is easy to standardize. It has high repeatability, easy operation and high safety. This document is intended to serve ergonomics experts in measuring populations, obtaining biomechanical data on human motion, and applying them to For the design of products, daily work and living spaces and work tasks. Biomechanical Measurement of Human Movement for Technology Design Basic Project

1 Scope

GB/T 44369-2024 establishes the basic biomechanical measurements of human motion for use in technological design: what a joint can move through, and how hard a limb can push. Anthropometry tells a designer how big people are; this document tells them what people can do, which is what actually determines whether a control can be reached and turned, a handle gripped, a pedal pressed or a lid opened by the population a product is meant for. It sets the measurement conditions, instruments and methods, then defines the centres of rotation of the wrist, elbow, shoulder, ankle, knee and hip, since a range of motion figure is meaningless without the axis it was measured about. It then gives twenty-four pages of range of motion measurement items covering the finger joints, wrist, forearm, elbow, shoulder, hip, knee, ankle, neck and trunk, and seventeen pages of static maximum strength measurement items covering the hand, wrist, forearm rotation, elbow, shoulder, hip, knee, ankle and multi-joint muscle groups, each with its posture, fixation and procedure. Two informative annexes cover how such measurement campaigns are organised and conducted. It applies to the determination and application of human motion biomechanical data in ergonomics, and exists specifically so that measurements made by different organisations are consistent and comparable.

This document provides basic items for measuring joint range of motion and static maximum strength for technical design, as well as related Appropriate measurement method. This document applies to the determination and application of biomechanical data of human movement in the field of ergonomics technology. This document is intended to ensure consistency and comparability of results between different groups and organizations in the measurement of human motion biomechanics.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document.

GB/T 5703 Basic items of human body measurement for technical design

3 Terms and definitions

The terms and definitions defined in GB/T 5703 and the following apply to this document.

3.1 static contraction A form of muscle contraction in which the distance between the origin and insertion of a muscle or muscle group does not change and there is no obvious joint movement.

Note. This form of contraction is also called isometric contraction.

3.2 The maximum force that a muscle or muscle group can exert during static contraction.

Note. Also known as isometric peak muscle strength or maximum voluntary contraction strength.

3.3 Flexion Movement of two adjacent limbs toward each other in the sagittal plane.

Note. The ankle and knee flex in the opposite direction.

3.4 extension Movement of two adjacent limbs in opposite directions away from each other in the sagittal plane.

Note. The ankle and knee joints extend in the opposite direction.

3.5 Abduction Movement of the extremity away from the trunk in the frontal plane.