



Designation: F3323 – 24

Standard Terminology for Exoskeletons and Exosuits¹

This standard is issued under the fixed designation F3323; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This terminology covers terms associated with exoskeletons and exosuits. By providing a common and consistent lexicon, the purpose of this terminology is to facilitate communication between individuals who may be involved in the research, design, deployment, and use of exoskeletons and exosuits in applications, including but not limited to industrial, military, emergency response, recreational, and medical areas.

1.2 For the terminology to be harmonious with the practices in the fields, definitions have been drawn from other standards, the literature, or other public sources when possible. When no definition is available, is similar but requires change for use within standards produced by Committee F48, or in dispute, a consensus-based approach will be used to resolve definitions and add them to the lexicon. The development of this terminology is taking place in close coordination with corresponding efforts in all Committee F48 subcommittees to ensure comprehensive and consistent coverage.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

F3200 Terminology for Robotics, Automation, and Autonomous Systems

¹ This terminology is under the jurisdiction of ASTM Committee F48 on Exoskeletons and Exosuits and is the direct responsibility of Subcommittee F48.91 on Terminology.

Current edition approved June 1, 2024. Published June 2024. Originally approved in 2018. Last previous edition approved in 2021 as F3323 – 21. DOI: 10.1520/F3323-24.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

F3358 Practice for Labeling and Information for Exoskeletons

F3392 Practice for Exoskeleton Wearing, Care, and Maintenance Instructions

F3427 Practice for Documenting Environmental Conditions for Utilization with Exoskeleton Test Methods

F3443 Practice for Load Handling When Using an Exoskeleton

F3444/F3444M Practice for Training Exoskeleton Users

F3517 Practice for Movement Tests When Using an Exoskeleton

F3518 Guide for Quantitative Measures for Establishing Exoskeleton Functional Ergonomic Parameters and Test Metrics

F3519 Guide for Establishing a Reporting Structure for Exoskeleton Analysis

F3523 Test Method for Exoskeleton Use: Confined Space: Horizontal Movement

F3527 Guide for Assessing Risks Related to Implementation of Exoskeletons in Task-Specific Environments

F3528 Test Method for Exoskeleton Use: Gait

F3540 Guide for Hazards for Consideration when Designing Exoskeletons

F3578 Test Method for Evaluating Exoskeleton Fall Risk due to Stumbling

F3581 Test Method for Exoskeleton Use: Hurdles

F3582 Test Method for Exoskeleton Use: Gaps

F3583 Test Method for Exoskeleton Use: Beams

F3584 Test Method for Exoskeleton Use: Obstacle Avoidance: Walking

2.2 ANSI Standards:³

ANSI/ITSDF B56.5 Safety Standard for Driverless, Automatic Guided Industrial Vehicles and Automated Functions of Manned Industrial Vehicles

2.3 IEC Standards:⁴

IEC 60601-1-8:2012 Medical electrical equipment – Part 1–8: General requirements for basic safety and essential performance – Collateral standard: General requirements,

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from International Electrotechnical Commission (IEC), 3, rue de Varembe, 1st floor, P.O. Box 131, CH-1211, Geneva 20, Switzerland, <https://www.iec.ch>.

tests and guidance for alarm systems in medical electrical equipment and medical electrical systems

2.4 *ISO Standards*:⁵

ISO 8373:2012 Robots and Robotic Devices—Vocabulary

ISO 13482:2014 Robots and robotic devices – Safety requirements for personal care robots

ISO/DIS 18646-4 Robotics — Performance criteria and related test methods for service robots — Part 4: Lower-back support robots

ISO/IEC Guide 51:2014 Safety aspects — Guidelines for their inclusion in standards

2.5 *Federal Standards*:⁶

MIL-HDBK-1908:1995 Definitions of Human Factors Terms

29 CFR 1910.132 Occupational Safety and Health Standards, Personal Protective Equipment, General Requirements

3. Terminology

accompanying literature, *n*—printed material or electronic records that accompanies the product when it is sold or distributed. **F3358 – 20**

activity, *n*—execution of a task or action by a user or their exoskeleton or exosuit, or both.

adaptive control, *n*—control scheme whereby the control system parameters are adjusted from conditions detected during the process. **ISO 8373:2012**

alarm condition, *n*—state of the alarm system when it has determined that a potential or actual hazardous situation exists for which operator or user awareness or response is required.

DISCUSSION—An alarm condition can be invalid, that is, a false positive alarm condition.

DISCUSSION—An alarm condition can be missed, that is, a false negative alarm condition. **IEC 60601-1-8:2012**

analysis requestor (sometimes called analysis sponsor), *n*—person or organization selecting the analysis and defining the conditions under which they are performed. **F3200 – 18; F3519 – 21**

analysis supervisor, *n*—person responsible for setting up the apparatus, instrumentation, directing, and reporting results of the analysis according to the analysis requestor or analysis sponsor. **F3200 – 18a; F3519 – 21**

anthropometric dimensions, *n*—measured dimensions that describe the size and shape of the human body. These dimensions are often presented in the form of summary statistics that describe the range of body dimensions that are observed in a population. **MIL-HDBK-1908 11 December 1995**

⁵ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

⁶ Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.access.gpo.gov>.

apparatus, *n*—a structure, object, test component, or artifact thereof, found or placed in an environment and used for a test. **F3517 – 21; F3523 – 21; F3528 – 21; F3578 – 22; F3581 – 22; F3582 – 22; F3583 – 22; F3584 – 22**

artifact, *n*—a representative of real structure(s), object(s), or test component(s) and used for a test. **F3517 – 21; F3523 – 21; F3578 – 22**

assistance, caloric, *n*—degree to which the exoskeleton changes the user's total caloric energy consumption while the user is attempting and/or performing a task compared to not using an exoskeleton (see also **metabolic assistance**).

assistance, metabolic, *n*—degree to which the exoskeleton changes the user's rate of metabolism while attempting and/or performing a task compared to not using an exoskeleton (see also **caloric assistance**).

assistant, *n*—anyone who is not the user or the operator involved in enabling and within reach of the exoskeleton for it to function as intended.

assistive product, medical, *n*—any product (including devices, equipment, instruments, and software), especially produced or generally available, used to aid a person with an injury or disability: (1) for participation in activities of daily living, (2) to protect, support, train, measure, or substitute for body functions/structures and activities, or (3) to prevent impairments, activity limitations, or participation restrictions.

backpack or rucksack, *n*—a bag or frame with shoulder straps that allow it to be carried on one's back. **F3443 – 20**

bag, *n*—a filled (for example, with grain), flexible, sealed, object with no handle. **F3443 – 20**

bag, handle, *n*—object with handle(s) on top, typically carried to the side and below the arm, and may be flexible or rigid. **F3443 – 20**

beam, *n*—a narrow horizontal bar, on or raised off the floor, on or over which a user traverses. **F3583 – 22**

between area, *n*—the area of the apparatus that is between different environmental conditions in a transitional environment (see **transitional**). **F3427 – 20**

box, *n*—a container with a flat base and sides, typically square or rectangular that may include a lid and is held with hands from the container bottom or squeezed with hands on opposing sides. **F3443 – 20**

care, *n*—procedures for cleaning, sterilization, decontamination, and storage of the exoskeleton. **F3392 – 20**

change time, *n*—amount of time to change from one environmental condition to another (only applies to dynamic environments). **F3427 – 20**

confined space, *n*—limited entry and egress. **F3523 – 21**

contact information, *n*—information that allows a user to contact the manufacturer of the product, such as name, telephone number, and website address. **F3443 – 20**