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NATIONAL STANDARD OF THE
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ICS 03.120.99

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GB/T 29289.2-2025

Replacing GB/T 29289-2012

Safety in Consumer Products Life Cycle - Part 2: Design

消费品生命周期安全 第2部分：设计

Issued on: May 30, 2025

Implemented on: December 1, 2025

Issued by: State Administration for Market Regulation;

Standardization Administration of the People's Republic of China.

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Safety in Consumer Products Life Cycle - Part 2: Design

1 Scope

This document specifies the general processes for consumer product safety design, and describes information collection, intended use analysis, risk assessment and design methods.

This document is intended to guide relevant parties in conducting consumer product safety design activities.

2 Normative References

This document does not have normative references.

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 consumer product

Product designed and produced primarily, but not exclusively, for personal use.

NOTE: it includes product assemblies, components and parts, accessories, instructions and packaging. For detailed consumer product classification, see GB/T 36431.

[source: GB/T 35248-2017, 2.2, modified]

3.2 intended use

Use in accordance with the information provided with the product and / or system, or in the absence of such information, in accordance with commonly understood patterns of use.

[source: GB/T 20002.4-2015, 3.6, modified]

3.3 reasonably foreseeable misuse

Use of the product and / or system other than as provided by the supply-side, resulting from readily foreseeable human behavior.

[source: GB/T 20002.4-2015, 3.7]

3.4 hazard

Potential source of injury.

A situation in which people or property are exposed to one or multiple hazards.

[source: GB/T 20002.4-2015, 3.4, modified]

4 General Processes

The general processes for consumer product safety design are shown in Figure 1 and include the following parts:

- a) Information collection;
- b) Intended use analysis;
- c) Risk assessment;
- d) Safety design.

5 Information Collection

Information related to consumer product safety design may be collected from the following channels. The information source includes, but is not limited to:

- a) Relevant laws and regulations, including laws, administrative regulations and departmental rules;
- b) Relevant consumer product standards, including national standards, industry standards, group standards, and international and foreign standards, etc.;
- c) Relevant database information, such as recall notifications and spot check results, etc.;
- d) Simulation experiments, comparative tests, product testing, etc.;
- e) Consumer complaint information;
- f) Media reports;
- g) Industry research reports, expert opinions, etc.;
- h) Other relevant information.

6 Intended Use Analysis

6.1 Overview

Intended use analysis includes an analysis of the intended reasonable use, reasonably foreseeable misuse, and faults of a consumer product, and clarifies the correlations among the user population, consumer product characteristics, and usage environment.

6.2 User Population

6.2.1 General requirements

When designing a consumer product, an analysis of the consumer population shall be conducted, specifically including the consumer's gender, age, intelligence level, physical ability, education, risk appetite, and proficiency in using the consumer product.

6.2.2 User population categories

The intended user population of consumer products includes, but is not limited to, the following:

- a) The general population;
- b) People with special physical needs, such as the elderly, children, the disabled, and pregnant women.

- a) The pregnant women's physiological characteristics, body shape change patterns, changes in motion characteristics, and any resulting discomfort, etc.;
- b) The pregnant women's special demands for product materials, environmental sensitivity, strength and function, etc.;
- c) The pregnant women's demands for product usability;
- d) Others.

6.2.7 Usage behavior

The intended reasonable use and reasonably foreseeable misuse of the consumer product should be considered on the premise of not changing the product function.

6.3 Consumer Product Characteristics

The analysis of consumer product safety characteristics may include characteristic analysis of the following: product appearance, function, performance, physical hazard, chemical hazard, biohazard, information hazard, ethical hazard and others. The classification of the above-mentioned hazard is provided in Appendix C of GB/T 22760-2020 and Appendix B of GB/T 45097.1-2024.

6.4 Usage Environment

The analysis of the usage environment of consumer products primarily involves constructing potential hazardous situations for the consumer products and conducting an analysis of the product's usage space, temperature, humidity and other factors within each hazardous situation.

7 Risk Assessment

7.1 Overview

Risk assessment primarily involves three steps: hazard identification, risk estimation and risk evaluation. First, identify potential hazards that may cause injury at each stage of the consumer product life cycle, such as physical hazard, chemical hazard, biohazard, information hazard and ethical hazard. Construct hazardous situations and carry out risk estimation and risk evaluation to determine the product's risk level.

7.2 Hazard Identification

Hazard identification for consumer products may be conducted in accordance with Chapter 5 of GB/T 39011-2020 and Chapter 6 of GB/T 45097.1-2024.

7.3 Risk Estimation and Risk Evaluation

Risk estimation and risk evaluation for consumer products may be conducted in accordance

with Chapter 4 of GB/T 22760-2020, and Chapter 8 and Chapter 9 of GB/T 45097.2-2024.

8 Design Methods

8.1 Design Strategy

For hazards that cause risks exceeding the tolerable risk, product design improvements shall be implemented to achieve a tolerable risk level. When the proposed product design improvement method conflicts with enterprise costs, priority should be given to product design methods that achieve a tolerable risk level. Product design methods should be selected in accordance with the three steps of “direct safety design – indirect safety design – suggestive safety design”.

8.2 Direct Safety Design

8.2.1 General

The direct safety design of consumer products focuses on the intrinsic safety of consumer products. This refers to protective measures that eliminate hazards or reduce the risks associated with hazards by modifying product design or functional characteristics rather than by using protective devices or safeguards. Consumer products shall be designed to meet the demands of achieving existing functions and performance, and shall be suitable for the consumer population, consumer product characteristics and usage environment. In addition, based on all the possible hazards that have been identified in the consumer product life cycle, different intrinsically safe design measures shall be taken to control risks and reduce risks to a tolerable risk level.

8.2.2 Physical hazard

Design measures for physical hazard in consumer products may include, but are not limited to, the following contents:

- a) Mechanical hazard: consider product appearance, dimensions, shape, color, as well as assembly stability, strength, pressure space, elasticity, and kinetic energy fluctuations when designing the product.
- b) Explosion hazard: based on potential gas-phase, liquid-phase, and solid-phase explosion hazards, select appropriate materials, material combinations, and product structural design solutions;
- c) Noise hazard: based on potential stability, mobility and impulse noise hazards, optimize materials and reasonably design the structure, shape, and dimensions of assemblies;
- d) Electrical hazard: based on potential electric shock and electrical explosion hazards, select insulating and stable materials. In addition, optimize the combinational design by comprehensively considering factors, such as temperature, resistance, voltage and structure, etc.;

- e) High / low material hazard: based on potential high and low temperature hazards, select raw materials with thermal insulation and stable performance, and optimize the combinational design of the product's structure and shape, etc.;
- f) Radiation hazard: based on potential hazards, such as thermal radiation, radiation and electromagnetic radiation, select raw materials with radiation protection, and optimize the design of the product's dimensions, assemblies, shape and structure, etc.

8.2.3 Chemical hazard

Chemical hazard includes inorganic and organic chemical hazard. Based on the conclusions of product safety risk assessment, during the product design stage, in addition to selecting raw materials that comply with the requirements of laws, regulations, national standards and industry standards, comprehensive consideration shall be given to ensuring that the product remains compliant with the above-mentioned laws, regulations, and standards under multiple chemical hazard combinations or reasonably foreseeable misuse during use. Furthermore, strict control must be exercised over chemical hazard at all stages of the product's production processes, the use of additives, packaging, storage, and transportation, etc., to avoid intolerable risks caused by chemical hazard.

8.2.4 Biohazard

Biohazard includes pathogenic microorganisms and pathogenic biohazard. Based on the conclusions of the product safety risk assessment, during the product design stage, safe and hygienic raw materials and outer packaging shall be selected. In addition, scientific regulations shall be established for all stages of the use of additives during the production process, processes, packaging, storage and transportation, to avoid intolerable risks caused by chemical hazard (TRANSLATOR NOTE: it should be biohazard).

8.2.5 Information hazard

Design measures for information hazard may include, but are not limited to, the following contents:

- a) Data privacy leakage: develop a privacy policy for the collection and use of personal information, as well as the user's autonomy that needs to be satisfied in all links of collection, storage, use, processing, transmission, provision, public disclosure, sharing and transfer of personal information. Optimize the design of personal information retention periods, storage categories and durations, information deletion, and sensitive information handling, etc.
- b) Remote control risk: design functions, such as remote access control, identity authentication and user passwords.
- c) Device vulnerabilities and malicious software: consider the required ports and the number of the ports and reasonably design them. Based on the product's firmware update mechanism, update files, anti-tampering function and encryption processing

of key codes and important data, as well as the strength of encryption, etc., carry out product design;

- d) Network communication security risk: consider data confidentiality, integrity and replay attacks during data transmission; design reasonable protection mechanisms. Consider code security and avoid hard-coding sensitive information.

8.2.6 Ethical hazard

Design measures for ethical hazard may include, but are not limited to, the following contents:

- a) From the perspective of product design philosophy, prioritize the protection of fundamental human rights, such as freedom and dignity, uphold globally recognized morality and ethics, enhance human professional development and life experiences, and DO NOT compromise the status of human beings as principal actors;
- b) Product design shall adhere to the fundamental direction of promoting sustainable human development, protecting the interests of vulnerable groups, and not violating human morality and ethics;
- c) Data used in products shall be relatively objective, neutral and representative as a whole, while taking into account both universal applicability and the demands of specific populations;
- d) In terms of the design of the scope of information collection, the collection and use of personal information shall adhere to the principle of minimum necessity. In particular, the processing of sensitive personal information shall be based on the explicit consent of the personal information subject or specific circumstances stipulated by law;
- e) Product design should consider ensuring that the product can perform its specific function without malfunctions within a certain timeframe and under certain conditions, and that in the event of a malfunction, it shall be capable of effectively shutting down and enabling human control;
- f) In terms of product algorithm design, prioritize highly interpretable algorithm models to provide users with clear, understandable and comprehensive explanations of the product's operating mechanisms, and clearly inform users of the product's limitations and potential risks;
- g) The algorithm models and results of product design can be repeatedly verified under equal or approximate conditions.

8.3 Indirect Safety Design

8.3.1 Overview

Indirect safety design includes the design of supplementary protective measures, such as

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