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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 36954-2018

**Safety of machinery -- Implementation of ergonomic principles
in risk assessment and risk reduction**

机械安全 人类工效学原则在风险评估与风险减小中的应用

(English Translation)

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1 Scope

This standard gives the main ergonomic risk factors that affect the safety of machinery, and gives the Key principles of ergonomics, applying these key elements to the architecture of mechanical design.

- Avoid tense postures and movements during the use of the machine;
- Design easy-to-operate machines, especially hand-held or mobile machines;
- try to avoid noise, vibration and thermal effects;
- Avoid the operator's work rhythm being associated with the machine's automatic cycle;
- provide local lighting outside or inside the machine;
- The selection, location and identification of manual controls (actuators) shall be clearly visible, identifiable, and appropriately marked when necessary;
- Selection, design and location of indicators, dials and visual display units.

Note 1: Noise, vibration and adverse thermal environmental effects on health are recognized and are not given in this standard. However, environmental factors can interact with the design of the machine, This standard gives the risks resulting from this effect.

Note 2: The lighting of the machine or the lighting of the workplace around the machine has an important impact on the safety of operating the machine, and this standard gives this risk.

This method is based on the iterative process of GB/T 15706 and is used to identify major hazards and reduce risks.

The relevant steps of the iterative process have been adapted to incorporate ergonomic principles, and the application of ergonomics in relation to machine design is given. A practical guide to efficacy standards.

This standard applies to standard setters and machine designers. This standard can also be used when there is no relevant Class C standard.

2 Normative references

The following documents are essential for the application of this document. For dated references, only the dated version applies to this article pieces. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 15706-2012 General Principles of Mechanical Safety Design Risk Assessment and Risk Reduction (ISO 12100:2010, IDT)

3 Terms and Definitions

The terms and definitions defined in GB/T 15706-2012 and the following terms and definitions apply to this document.

3.1 Ergonomics

human factors study of human factors Study the interactions between people and other elements of the system, applying theories, principles, data and methods to design to improve the quality of human life The discipline of optimizing overall system performance. [Rewriting GB/T 16251-2008, 2.3]

3.2 Ergonomic hazard

Hazards arising from ergonomic principles are not adequately considered in the machine design process.

Note: For ergonomic hazards, see also Table B.1 in GB/T 15706-2012, No. 8.

4.1 Overview

The designer conducts risk assessment according to Chapter 5 of GB/T 15706-2012, and gives the information required for risk assessment, so as to be able to judge whether the Whether risk reduction is necessary. These judgments require the aid of qualitative estimates of the identified risks or, as the case may be, quantitative estimates count. This can be achieved by taking into account the usual risks of machine design as well as risks arising from failure to consider ergonomic principles.

Figure 1 gives an illustration of the risk reduction process derived from GB/T 15706-2012, showing how ergonomics can be integrated into risk

Reduce iterative three-step method (including references to relevant clauses of this standard).

4.2 Significant ergonomic hazards associated with GB/T 15706

Design without ergonomics can lead to potential consequences of discomfort, fatigue, musculoskeletal disorders, stress, and human error (see 4.3).

When these potential consequences are associated with machines, they are associated ergonomic hazards. Consequences such as discomfort and fatigue can also indirectly lead to human error. like If the potential consequences need to be regulated, these hazards are significant hazards as important as machine, electrical and other hazards (see GB/T 15706-2012, Table B.1).

Note 1 to entry. Discomfort and fatigue are relevant warning signs, because discomfort and fatigue

can lead to occupational disease or accidents and can affect performance and quality.

Note 2: The term "ergonomic hazard" used in GB/T 15706 is used to describe the danger caused by failure to fully consider ergonomics in the design process. To ensure consistency, this standard retains this term.

4.3.3 Fatigue

Fatigue is a state of impaired executive functioning due to current or previous physical and/or mental activity. Fatigue can be physical or Psychological, systemic or local. Fatigue levels depend on the intensity, duration, and timing patterns of these activities. Eliminating fatigue requires adequate Break time. Important factors that affect fatigue are.

- type of workload, psychological or physical;
- Work load intensity, such as the weight of the object to be handled, the complexity of the information to be processed;
- Repetitiveness of work content (highly repetitive work is more prone to fatigue);
- Recovery time, such as breaks.

NOTE: Physiological and psychological abilities vary between operators, and similarly, the same operator's ability, sensitivity to fatigue and other consequences can vary over time change with change.

4.3.4 Musculoskeletal disorders

Musculoskeletal disorders can be acute or chronic. Acute conditions are usually caused by some form of muscle overload, such as working A tear or injury to a muscle or other soft tissue mechanism caused by too much effort or with other characteristics such as suddenness.

Chronic diseases often result from persistent or repetitive work that exceeds the body's ability to restore and repair. sometimes unaccustomed Movement can also be dangerous, and adding a guide or learning process can help.

Certain ailments can be acute or chronic. For example, some tendon problems may be caused by short-term overload (acute) or Can be caused by repetitive activities that last for a long time.

Static loading (the application of force without movement) can also cause problems because muscle movement is an integral part of the muscle recovery or repair process part. Major aspects affecting musculoskeletal disorders.

- Force requirements (related to the size of the relevant body part, larger muscles usually produce larger forces);