

ICS 13.180
CCS A 25



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

GB/T 18048-2026

Replacing GB/T 18048-2008

**Ergonomics of the thermal environment - Determination of
metabolic rate**

热环境人类工效学 代谢率的测定

(English Translation)

Issued on: April 30, 2026

Implemented on: November 1, 2026

Issued by: State Administration for Market Regulation

Table of Contents

Preface	
Introduction	
1 Scope	
2 Normative References	
3 Terms and Definitions	
4 Units	
5 Four Levels of Metabolic Rate Estimation Methods	
6 First-stage screening method. Classification of metabolic rate types	
7 Second-level observation method	
7.1 Estimating the metabolic rate of specific activities	
7.2 Estimating the average metabolic rate over a given period of time	
7.3 Accuracy	
8 Third-level analytical method	
8.1 Estimating metabolic rate using heart rate	
8.2 Estimating metabolic rate through acceleration measurements	
9 Fourth-level measurement method	
9.1 Determining metabolic rate using oxygen consumption	
9.2 Long-term metabolic rate measurement using the double-standard water method	
9.3 Principle of Direct Calorimetry for Assessing Metabolic Rate	
Appendix A (Informative) Estimation of Metabolic Rate Using First-Level Methods (Screening Method)	
Appendix B (Informative) Estimation of Metabolic Rate Using Second-Level Methods (Observational Method)	
Appendix C (Informative) Estimation of Metabolic Rate Using Third-Level Methods (Analytical Methods)	
Appendix D (Informative) Estimation of Metabolic Rate Using Level IV Methods (Measurement Methods)	
Appendix E (Normative) Thermal Effects of Correcting Heart Rate Measurements	
References	

Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document replaces GB/T 18048-2008 "Determination of Metabolic Rate in Thermal Environments" and is consistent with GB/T 18048-2008.

Compared to previous versions, aside from structural adjustments and editorial changes, the main technical changes are as follows.

---Added the use of the methods described in this document to estimate task-specific metabolic rates, denoted by "W" (see Chapter 4);

---The method of classifying metabolic rates by occupation in the first-level screening method has been removed (see 4.1 in the 2008 version);

---The revised procedure for assessing metabolic rate for specific activities (Level 2 observation method) has been changed (see Chapter 7, 2008 edition).

Chapter 5);

---The revised procedure for assessing metabolic rate using heart rate (third-level resolution) has been changed (see Chapter 8, Chapter 6 of the 2008 edition);

---The overall method in the fourth level of measurement has been removed (see 7.1.1 in the 2008 version).

This document is equivalent to ISO 8996:2021 "Ergonomics of thermal environments - Determination of metabolic rate".

The following minimal editorial changes have been made to this document.

---The statement in Chapter 6 of ISO, "Interpolation cannot be used between 4 categories," should be corrected to "Interpolation cannot be used between 5 categories." the word "use" is consistent with the previous text.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed and is under the jurisdiction of the National Technical Committee on Ergonomics Standardization (SAC/TC7).

Introduction

Metabolic rate is the rate at which the human body converts chemical energy into mechanical and thermal energy. It can be used to measure physical exertion caused by

muscle load.

Exhaustion can also quantitatively estimate the intensity of some activities. Metabolic rate is an important factor determining the degree of comfort or injury experienced by people exposed to thermal environments.

Certain factors. Especially in hot climates, the large amount of metabolic heat generated by muscle activity exacerbates heat stress, and a large amount of heat needs to be dissipated.

Most of the heat loss occurs through sweat evaporation. Conversely, in cold environments, a large amount of metabolic heat production helps compensate for excessive heat loss through the skin.

This reduces cold damage.

The estimation methods, tables, and other data used in this document are based on the general working population. If the target population is children or the elderly...

When used by adults or special groups such as the disabled, modifications will be made as needed. The physical exertion resulting from physical movement (walking or climbing) will be considered.

Metabolic rate is assessed using physical characteristics such as body weight (see Appendix B). When assessing metabolic rate using heart rate, sex, age, and body weight should be considered.

Important factors (see Appendix C).

Determination of metabolic rate in thermal environment ergonomics

1 Scope

This document describes methods for determining various metabolic rates under working thermal conditions. This document is applicable to work performance assessments, specific job requirements, and physical conditions.

This includes estimating physical exertion from sports and other activities, as well as estimating the total energy expenditure for specific activities. Metabolic rate estimation methods are divided into four levels, with their accuracy decreasing in the following order.

Improvement. First-level screening method, the table provides examples of low, medium and high metabolic rates of activity; second-level observation method, through time and motion studies to estimate...

The third-level analytical method estimates metabolic rate by recording heart rate or measuring acceleration; the fourth-level measurement method employs more complex techniques.

Perform metabolic rate measurements.

This document describes the procedures for measuring various metabolic rates and discusses uncertainties.

2 Normative references

This document has no normative references.

3 Terms and Definitions

This document does not contain any terms or definitions that need to be defined.

The URLs for the terminology databases maintained by ISO and IEC for standardization are as follows.

4 Units

The metabolic rate estimated using the methods described in this document for a specific task should be expressed in watts (W).

If the task does not involve physical movement, the metabolic rate will not change with the subject's volume and weight. If the task involves physical movement, the effect of this person's body weight on their metabolic rate should be explained (see Appendix B).

The body's heat production, which is related to metabolic rate, is mainly released through the skin. Thermophysiolgists usually use the metabolic rate per unit body surface area (W/m^2).

This indicates that estimates of thermal comfort and heat stress in ISO 7243, ISO 7730, ISO 7933, and ISO 11079 use W/m^2 as the unit.

Xie Lulai expressed this.

5 Four levels of metabolic rate estimation methods

The mechanical efficiency of muscle activity in producing "useful work" is relatively low; for most manual tasks, the proportion of "useful work" is very small (only...).

(A few percent), usually negligible. Therefore, it is assumed that the total energy consumed during work equals the total heat generated. This document assumes that people...

The metabolic rate is equal to the rate at which the body generates heat.

Table 1 lists several methods for determining metabolic rate. These methods are based on ISO 15265 regarding human exposure to thermal environments.

Based on the fundamental principles, it is divided into 4 levels.

First-level screening method. A simple and easy-to-implement method is proposed to