

ICS 25.180.10

CCS K 61



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

GB/T 40816.1-2024

**Industrial furnaces and associated processing equipment -
Method of measuring energy balance and calculating efficiency
- Part 1: General methodology**

工业炉及相关工艺设备 能量平衡测试及能效计算方法 第1部分：通用方法
(English Translation)

Issued on: October 26, 2024

Implemented on: May 1, 2025

**Issued by: State Administration for Market Regulation, China National
Standardization Administration**

Table of Contents

Preface	
Introduction	
1 Scope	
2 Normative references	
3 Terms and Definitions	
4 Symbols	
5 Basic Principles	11
6 Measurement and calculation of basic conditions	
7 Energy types and their systematization	
8 Measurement methods	
9 Calculation	
10 Energy Balance Assessment Report	
Appendix A (Informative) Uncertainty Assessment of Total Energy Efficiency	
Appendix B (Informative) Measurement methods for regenerative burners	
Appendix C (Informative) Reference Data	
Appendix D (Informative) Calculation of Water Vapor Content in Fuel and Air	
Appendix E (Informative) Multi-layer composite furnace wall heat storage, temperature distribution and heat loss calculation	
Appendix F (Informative) Calculation of furnace wall heat loss and furnace exhaust heat loss	
Appendix G (Informative) Calculation of Fluid Transport Energy	
Appendix H (Informative) Example of an Energy Balance Assessment Report	
Reference	

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.

This document is Part 1 of GB/T 40816 "Energy balance test and energy efficiency calculation method for industrial furnaces and related process equipment".

GB/T 40816 has published the following parts.

- Part 1: General methods;
- Part 2: Steel heating furnace;
- Part 11: Various efficiency assessments.

This document is equivalent to ISO 13579-1:2013 "Energy balance test and energy efficiency calculation method for industrial furnaces and related process equipment" Part 1: General methods.

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

- Deleted etat in Chapter 4 of ISO 13579-1:2013 (because etat and etac are repeated);
- Modified the note to 6.5 in ISO 13579-1:2013 (due to an error in the international standard);
- Modified the value of the excess air factor in 9.1 of ISO 13579-1:2013 (due to an error in the international standard).

Introduction

Industrial furnaces and related process equipment are thermal equipment that use heat from fuel combustion or electrical energy conversion to heat materials or workpieces.

Evaluate the energy efficiency of industrial furnaces and related process equipment, formulate GB/T 40816 "Energy balance test and energy efficiency of industrial furnaces and related process equipment" GB/T 40816 is intended to specify the energy balance test and energy efficiency calculation method for industrial furnaces and related process equipment.

The law is intended to consist of five parts.

- Part 1: General method. The purpose is to describe the general method for energy balance test and energy efficiency calculation of industrial furnaces and related process equipment.

method.

- Part 2: Steel heating furnace. The purpose is to describe the special method of energy balance test and energy efficiency calculation of steel heating furnace.

- Part 3: Batch aluminum melting furnaces. The purpose is to describe the special methods for energy balance test and energy efficiency calculation of batch aluminum melting furnaces.

- Part 4: Protective or reactive atmosphere furnaces. The purpose is to describe the energy balance test and energy balance of protective or reactive atmosphere furnaces.

Special methods for efficient calculation.

--- Part 11: Various efficiency evaluations. The purpose is to describe various efficiency evaluation methods for industrial furnaces and related process equipment.

Other parts are formulated in accordance with this document and used in conjunction with this document.

Energy balance test of industrial furnaces and related process equipment Energy efficiency calculation method Part 1: General method

1 Scope

This document specifies a general method for energy balance and energy efficiency calculation of industrial furnaces and related process equipment. The general method includes.

---Measurement method;

---Calculation (general calculation);

---Energy balance assessment report.

This document does not apply to any efficiency related to the process itself other than industrial furnaces and related process equipment (for example, in steel rolling processes).

The steel heating furnace is the only component covered by this document).

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 40816.2-2024 Energy balance test and energy efficiency calculation method for industrial furnaces and related process equipment Part 2: Steel processing Hot oven (ISO 13579-2:2013, IDT) ment-Vocabulary) ISO 13579-3:2013 Industrial furnaces and related process equipment - Energy balance test and energy efficiency calculation methods - Part 3: Intermittent

3 Terms and Definitions

For the purposes of this document, the terms and definitions defined in ISO 13574 and the following apply.

3.1.1 Total energy input

3.1.1.1

Total energy input the sum of the measured energy inputs brought into the energy balance area, consisting of fuel equivalent energy and other energy inputs.

3.1.2 Fuel Equivalent Energy

3.1.2.1

fuel equivalent energy fuel equivalent energy the sum of the input energy consisting of the calorific value of the fuel, the calorific value of the waste, the calorific value of the atmosphere gas source gas and the fuel equivalent electrical energy.