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## Industrial furnaces and associated processing equipment — Method of measuring energy balance and calculating efficiency —

### Part 4: Furnaces with protective or reactive atmosphere

*Fours industriels et équipements associés — Méthode de mesure du bilan énergétique et de calcul de l'efficacité —*

*Partie 4: Fours à atmosphère contrôlée ou active*

ICS 25.180.01

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 13579-4 was prepared by Technical Committee ISO/TC 244, *Industrial furnaces and associated thermal processing equipment*.

ISO 13579 consists of the following parts, under the general title *Industrial furnaces and associated processing equipment — Method of measuring energy balance and calculating efficiency*:

- Part 1: General methodology
- Part 2: Reheating furnaces for steel
- Part 3: Batch type aluminium melting furnaces
- Part 4: Furnaces with protective or reactive atmosphere

## Introduction

All calculations within this standard are based on the location of equipment at the reference conditions.

NOTE For equipment intended to be installed other than the sea level the impact of the elevation should be calculated for that location.

Symbols used in this part 4 of this standard and all the annexes attached to this part 4 of this standard, together with their meaning and units, are given in Annex A.

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# Industrial furnaces and associated processing equipment — Method of measuring energy balance and calculating efficiency —

## Part 4: Furnaces with protective or reactive atmosphere

### 5 1 Scope

6 This Part 4 of ISO 13579 specifies general methodology of measuring energy balance and calculating  
7 efficiency of the process involving furnaces with protective or reactive atmosphere as designed by the furnace  
8 manufacturers. This general methodology includes:

9 Measurement methods,

10 Calculations (general calculation) and

11 Evaluation report.

12 This standard is excluding any efficiencies related to the process itself outside of the furnaces with protective  
13 or reactive atmosphere.

### 14 2 Normative references

15 The following referenced documents are indispensable for the application of this document. For dated  
16 references, only the edition cited applies. For undated references, the latest edition of the referenced  
17 document (including any amendments) applies.

18 ISO 13574, Industrial furnaces and associated thermal processing equipment — Vocabulary

19 ISO 13579-1, Industrial furnaces and associated thermal processing equipment — Method of measuring  
20 energy balance and calculating efficiency — Part 1: General methodology

### 21 3 Terms and definitions

22 The terms and definitions used in this part of Standard is defined in ISO 13574, Industrial furnaces and  
23 associated thermal processing equipment — Vocabulary.

### 24 4 Basic principles

#### 25 4.1 General

26 Area of energy balance measurement shall be determined.

27 NOTE An example of determination of the area of energy balance measurement of furnaces with protective or  
28 reactive atmosphere are shown in Figure 1 and Figure 2.

29 The following aspects shall be included in the energy balance measurement:

30 a) Energy input;

31 — "Fuel equivalent energy" as specified in 4.2.2;

32 — "Other energy input" as specified in 4.2.3;

33 b) Energy output;

34 — "Thermal energy output" as specified in 6.2.5;

35 — "Energy used in electrical auxiliary equipment" as specified in 6.2.6;

36 — "Energy for generation of utilities" as specified in 6.2.7;

37 — "Electrical generation loss" as specified in 6.2.8.

38 Determine energy input and energy output which goes into and comes out of the area of energy balance  
39 based on the measurement data.

40 The total energy input into the area shall balance the total energy output from the area.

41 Result of energy balance measurement is required to be summarized into energy input and energy output in  
42 an energy balance sheet with necessary information such as equipment summary, measurement condition  
43 and measurement data.

44 Thermal energy balance and electrical generation may be created as subcategories. See 6.3 and 6.4.

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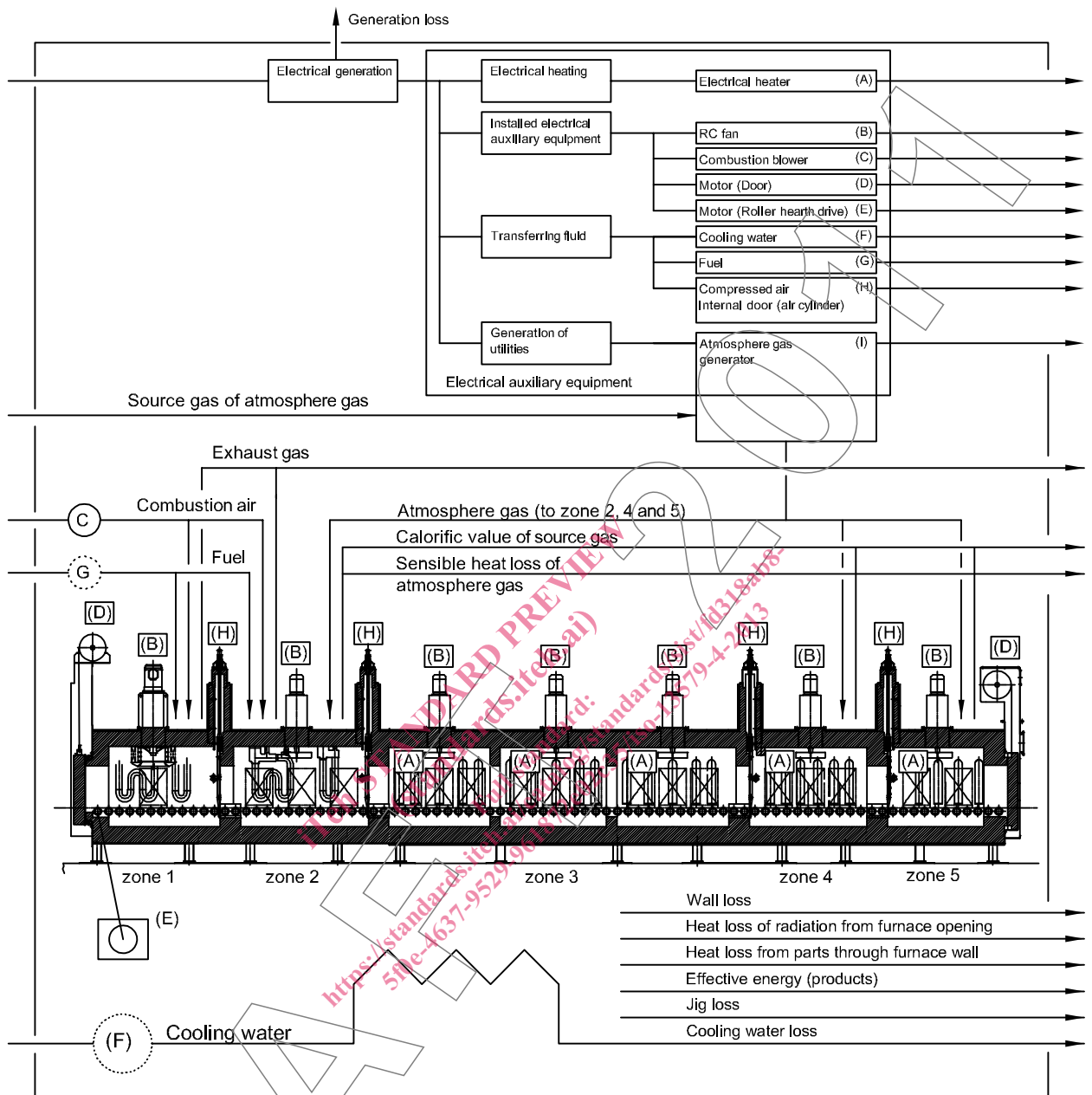
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Figure 1 — Example of determination of the area of energy balance  
Continuous carburizing furnace

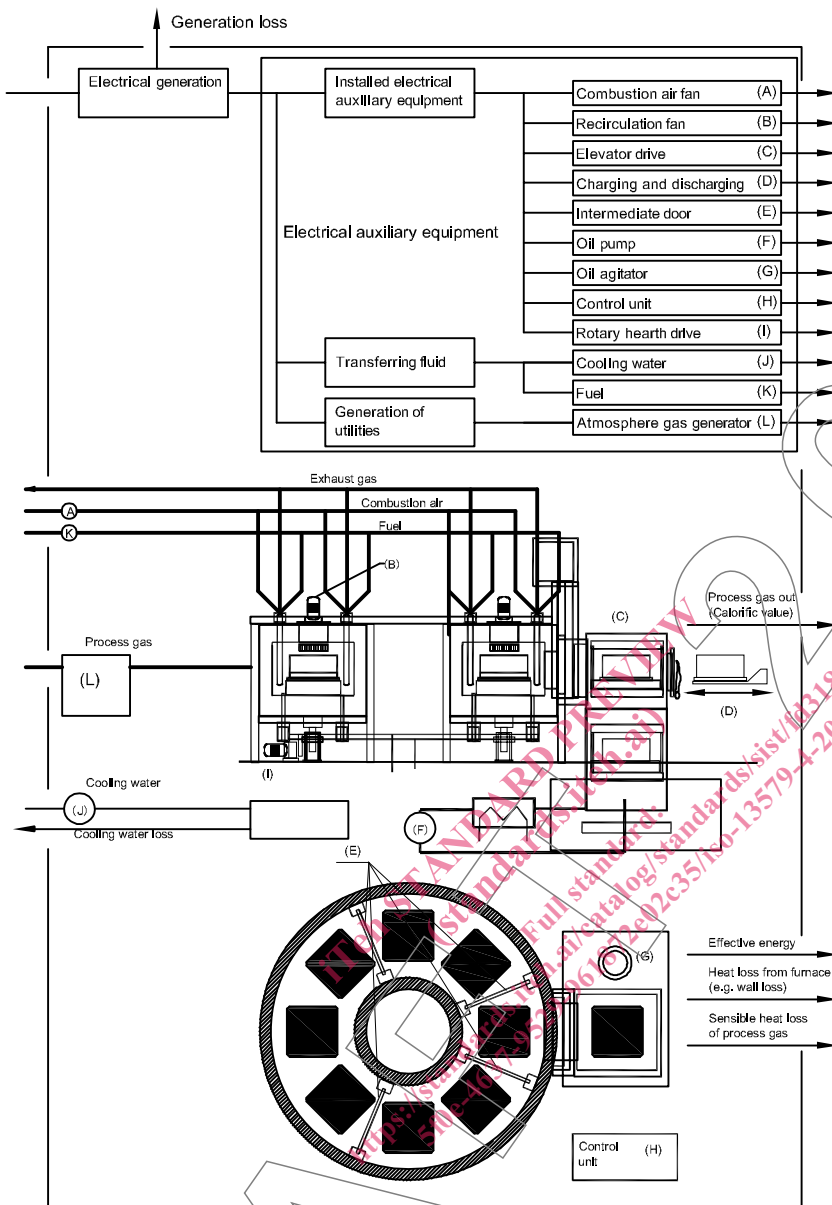


Figure 2 — Example of determination of the area of energy balance  
Rotary hearth furnace

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51 **4.2 Sankey diagram**

52 As specified in ISO/CD 13579-1 4.2.

53 **4.3 Process Heating Assessment Survey Tool (PHAST)**

54 As specified in ISO/CD 13579-1 4.3.

## 55 **5 Basic condition of measurement and calculation**

### 56 **5.1 State of furnace**

57 As specified in ISO/CD 13579-1 5.1

### 58 **5.2 Duration of measurement**

59 As specified in ISO/CD 13579-1 5.2.

### 60 **5.3 Unit of specific energy intensity**

61 As specified in ISO/CD 13579-1 5.3.

### 62 **5.4 Reference condition**

63 As specified in ISO/CD 13579-1 5.4.

### 64 **5.5 Unit of volume**

65 As specified in ISO/CD 13579-1 5.5.

### 66 **5.6 Fuel**

67 As specified in ISO/CD 13579-1 5.6.

## 68 **6 Type of energy used in this standard**

### 69 **6.1 General**

70 Energy evaluated in this standard and their symbols are specified in this clause.

71 All energy shall be expressed in kJ/t products unless otherwise specified.

72 NOTE The types of energy specified in this clause are summarized in the Table 1.

### 73 **6.2 Energy balance**

#### 74 **6.2.1 Total energy input**

##### 75 **6.2.1.1**

76 **Total energy input**  $E_{input}$

77 As specified in ISO/CD 13579-1 6.2.1.1.

#### 78 **6.2.2 Fuel equivalent energy**

##### 79 **6.2.2.1**

80 **Fuel equivalent energy**  $E_{fe}$

81 As specified in ISO/CD 13579-1 6.2.2.1.