

Industrial furnaces and associated processing
equipment - Safety - Part 4: Protective systems (ISO
13577-4:2022)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 13577-4:2022 sisaldab Euroopa standardi EN ISO 13577-4:2022 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 13577-4:2022 consists of the English text of the European standard EN ISO 13577-4:2022.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 27.07.2022.	Date of Availability of the European standard is 27.07.2022.
Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The standard is available from the Estonian Centre for Standardisation and Accreditation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 13.100, 25.180.01

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardimis- ja Akrediteerimiskeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardimis-ja Akrediteerimiskeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardimis-ja Akrediteerimiskeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation and Accreditation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation and Accreditation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation and Accreditation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

**Industrial furnaces and associated processing equipment -
Safety - Part 4: Protective systems (ISO 13577-4:2022)**

Fours industriels et équipements associés - Sécurité -
Partie 4: Systèmes de protection (ISO 13577-4:2022)

Industrielle Thermoprozessanlagen und dazugehörige
Prozesskomponenten - Sicherheitsanforderungen - Teil
4: Schutzsysteme (ISO 13577-4:2022)

This European Standard was approved by CEN on 27 June 2022.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (EN ISO 13577-4:2022) has been prepared by Technical Committee ISO/TC 244 "Industrial furnaces and associated processing equipment" in collaboration with Technical Committee CEN/TC 186 "Industrial thermoprocessing - Safety" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2023, and conflicting national standards shall be withdrawn at the latest by January 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national standards body/national committee. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Endorsement notice

The text of ISO 13577-4:2022 has been approved by CEN as EN ISO 13577-4:2022 without any modification.

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Design requirements for equipment in a protective system	4
4.1 General	4
4.2 Requirements for protective systems	6
4.2.1 Overview of methods	6
4.2.2 Method A	7
4.2.3 Method BC	8
4.2.4 Method D	10
4.3 Fault assessment for the wired section of protective systems	11
4.4 Failure of utilities	12
4.5 Reset	12
5 Information for use	12
Annex A (informative) Explanation of techniques and measures for avoiding systematic faults	13
Annex B (normative) Wiring of protective systems	15
Annex C (informative) Examples for the determination of safety integrity level (SIL) or performance level (PL) using the risk graph method	29
Annex D (informative) Example of a risk assessment for one safety instrumented function using the method according to the IEC 61511:2016 series	45
Annex E (informative) Examples for protective functions	53
Annex F (normative) Requirements for application software	82
Bibliography	84

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 244, *Industrial furnaces and associated processing equipment*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 186, *Industrial thermoprocessing - Safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 13577-4:2014), which has been technically revised.

The main changes are as follows:

- to provided better clarity methods B and C were combined to create a new method BC,
- [Annex E](#) was rewritten to provide several new examples to better reflect the intent for previously misunderstood elements,
- [Annex B](#) was modified to include clearer language and examples of normative wiring. The original [Annex F](#) was merged,
- created wording to provide a better alignment with IEC 62061, IEC 61511, and ISO 13849-1.

A list of all parts in the ISO 13577 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document was developed to specify the requirements of a protective system, which is a safety-related control system (SCS) of industrial furnaces and associated processing equipment (TPE). It is intended that in designing the protective system of TPE, manufacturers of TPE choose from the three methods provided in this document. Requirements for safety-related control functions of TPE are specified in ISO 13577-1, ISO 13577-2, and ISO 13577-3.

This document is intended to be used jointly with ISO 13577-1, ISO 13577-2 and ISO 13577-3. Since the other parts of the ISO 13577 series are type-C standards of ISO 12100, TPE are required to be designed in accordance with the principles of ISO 12100. The type-B standards of ISO 12100 for SCS are IEC 62061 or ISO 13849-1, which always assume high-demand applications. However, there are cases in which a risk assessment according to the IEC 61511 series, which provides the option of a low-demand rate on the protective system, is more suitable for the design of a TPE protective system.

In principle, when requirements of ISO 13577-1, ISO 13577-2 and ISO 13577-3 (type-C standards) are different from those which are stated in type-A or -B standards, the requirements of the type-C standards take precedence over the requirements of the other standards for machines, which have been designed and built according to the requirements of the type-C standards. Therefore, this document permits risk assessment for safety-related electrical control systems (SRECS) in which risk assessment based on the IEC 61511 series can be chosen as an alternative.

Industrial furnaces and associated processing equipment — Safety —

Part 4: Protective systems

1 Scope

This document specifies the requirements for protective systems used in industrial furnaces and associated processing equipment (TPE).

The functional requirements to which the protective systems apply are specified in ISO 13577-1 ISO 13577-2 and ISO 13577-3.

This document is not applicable to blast furnaces, converters (in steel plants), boilers, fired heaters (including reformer furnaces) in the petrochemical and chemical industries.

This document is not applicable to electrical cabling and power cabling upstream of the TPE control panel/protective system.

This document is not applicable to the protective systems manufactured before the date of its publication.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13574, *Industrial furnaces and associated processing equipment — Vocabulary*

ISO 13849-1:—,¹⁾ *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

IEC 60947-4-1:2018, *Low-voltage switchgear and controlgear — Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters*

IEC 60947-5-1:2016, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices*

IEC 60204-1:2016, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60730-2-5:2013+AMD1:2017+AMD2:2020 CSV, *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems*

IEC 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 1: General requirements*

IEC 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*

IEC 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 3: Software requirements*

1) Fourth edition under preparation. Stage at the time of publication: ISO/DIS 13849-1:2022.

IEC 61508-4:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 4: Definitions and abbreviations*

IEC 61508-5:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 5: Examples of methods for the determination of safety integrity levels*

IEC 61508-6:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3*

IEC 61508-7:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 7: Overview of techniques and measures*

IEC 61131-3:2013, *Programmable controllers — Part 3: Programming languages*

IEC 61511-1:2016, *Functional safety — Safety instrumented systems for the process industry sector — Part 1: Framework, definitions, system, hardware and application programming requirements*

IEC 61511-2:2016, *Functional safety — Safety instrumented systems for the process industry sector — Part 2: Guidelines for the application of IEC 61511-1:2016*

IEC 61511-3:2016, *Functional safety — Safety instrumented systems for the process industry sector — Part 3: Guidance for the determination of the required safety integrity levels*

IEC 62061:2021, *Safety of machinery - Functional safety of safety-related control systems*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 final element

part of a *protective system* (3.6), that implements the physical action necessary to achieve or maintain a safe state

Note 1 to entry: Examples are valves, switch gears, and motors, including their auxiliary elements, for example, a solenoid valve and actuator if involved in the safety function.

[SOURCE: IEC 61511-1:2016, 3.2.22, modified — "BPCS or SIS" has been changed to read "protective system" in the definition.]

3.2 flame detector device

device by which the presence of a flame is detected and signalled

Note 1 to entry: It can consist of a flame *sensor* (3.9), an amplifier, and a relay for signal transmission.

[SOURCE: ISO 13574:2015, 2.65, modified — The second sentence in the original definition is presented as Note 1 to entry.]

3.3 logic function

function which performs the transformations between input information [provided by one or more input functions or *sensors* (3.9)] and output information [used by one or more output functions or *final elements* (3.1)]

Note 1 to entry: Logic functions are executed by the *logic solver* (3.4) of a *protective system* (3.6).