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Industrial furnaces and associated processing equipment — Safety —

Part 2: Combustion and fuel handling systems

Fours industriels et équipements associés — Sécurité —

Partie 2: Équipement de combustion et de manutention des combustibles

Reference number
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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.

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 document 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).

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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 13577-2:2014), which has been technically revised.

The main changes are as follows:

— revised document structure with requirements consolidated for the different fuels;

— improvement and specification of the requirements for testing the fuel pipework after construction;

— addition of requirements for gas pressure boosting systems;

— integration of selected requirements from the regional annexes into the global standard text;

— requirements for solid fuels removed;

— additional informative annex listing relevant product standards for components in the different regions.

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.

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Introduction

This document is a type-C standard as defined in ISO 12100:2010.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.)

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e.g. for maintenance (small, medium and large enterprises);

— consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery/equipment concerned and the extent to which hazards, hazardous situations or hazardous events are covered, is indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or -B standards, the requirements of this type-C standard take precedence over the requirements of the other standards, for machines that have been designed and built according to the requirements of this type-C standard.

This document assumes that the equipment is installed in a ventilated area and does not create any potentially explosive atmosphere. The installation of a TPE in accordance with the requirements of this document will not by itself require a change to the classification of the TPE location according to IEC 60079-10-1:2020.

Conformance with product standards, e.g. ISO 22967:2010 or ISO 22968:2010 is not sufficient to ensure the minimum safety requirements for industrial furnaces and associated processing equipment (TPE). This document always has priority for TPE.

Industrial furnaces and associated processing equipment (TPE) generally consist of the following components:

— processing chamber (e.g. steel construction with lining and/or refractory);

— heating systems;

— protective system;

— control and instrumentation system / operator-control level.

ISO 13577-1:2016 provides the general safety requirements common to TPE. This document details in addition specific safety requirements for combustion and fuel handling systems that are part of TPE as listed in the Scope.

The requirements for protective systems are specified in ISO 13577-4:2022.

The requirements for reducing hazards from noise are given in ISO 13577-1:2016.

It is assumed that TPE are operated and maintained by trained personnel.

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Industrial furnaces and associated processing equipment — Safety —

Part 2: Combustion and fuel handling systems

1 Scope

This document specifies the safety requirements for combustion and fuel handling systems that are part of industrial furnaces and associated processing equipment (TPE), including single and multiple burner systems in thermoprocessing equipment and machines.

NOTE The general safety requirements common to TPE are provided in ISO 13577-1:2016. ISO 13577-1:2016, Annex B also includes a list of processes for which industrial furnaces and heating systems covered by the ISO 13577 series are used.

This document deals with significant hazards, hazardous situations and events relevant to combustion and fuel handling systems as listed in Annex A, when used as intended and under the conditions for use as described in the instruction handbook.

This document covers:

— fuel pipework downstream of and including the manual isolating valve;

— combustion air supply (including oxygen and oxygen enriched combustion air) and flue gas system;

— burner(s), burner system and ignition device;

— functional requirements for safety related control system.

This document applies to any oxidation of gaseous and liquid fuels with air or other gases containing free oxygen to release thermal energy in TPE. Annex B includes examples of gaseous and liquid fuels.

For thermal or catalytic post combustion and waste incineration, this document applies only to auxiliary burners designed to start-up and/or support the process.

The pressure hazard of the piping and components covered by this document is within the maximum pressure/size relationship of category I as specified in Annex C.

This document also gives the necessary requirements regarding information for use.

This document does not cover hazards from heating generated by electricity.

This document does not deal with the hazards created by the release of flammable substances from the products processed in the TPE.

This document is not applicable to combustion and fuel handling systems:

— of gas welding and allied processes;

— up-stream of the TPE manual isolating valve.

This document is not applicable to industrial furnaces and associated processing equipment (TPE), including single and multiple burner systems in thermoprocessing equipment and machines manufactured before the date of its publication.

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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.

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 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 49:1994, *Malleable cast iron fittings threaded to ISO 7-1*

ISO 228-1:2000, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 5817:2014, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

ISO 7005-1:2011, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

ISO 7005-2:1988, *Metallic flanges — Part 2: Cast iron flanges*

ISO 8434-1:2018, *Metallic tube connections for fluid power and general use — Part 1: 24° cone connectors*

ISO 8434-2:2007, *Metallic tube connections for fluid power and general use — Part 2: 37 degree flared connectors*

ISO 8434-3:2005, *Metallic tube connections for fluid power and general use — Part 3: O-ring face seal connectors*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13574:2015, *Industrial furnaces and associated processing equipment — Vocabulary*

ISO 13577-1:2016, *Industrial furnaces and associated processing equipment — Safety — Part 1: General requirements*

ISO 13577-4:2022, *Industrial furnace and associated processing equipment — Safety — Part 4: Protective systems*

ISO 16852:2016, *Flame arresters — Performance requirements, test methods and limits for use*

ISO 19879:2010, *Metallic tube connections for fluid power and general use — Test methods for hydraulic fluid power connections*

ISO 23550:2018, *Safety and control devices for gas and/or oil burners and appliances — General requirements*

ISO 23551-1:2012, *Safety and control devices for gas burners and gas-burning appliances — Particular requirements — Part 1: Automatic and semi-automatic valves*

ISO 23551-2:2018, *Safety and control devices for gas burners and gas-burning appliances — Particular requirements — Part 2: Pressure regulators*

ISO 23551-5:2014, *Safety and control devices for gas burners and gas-burning appliances — Particular requirements — Part 5: Manual gas valves*

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ISO 23551-6:2014, *Safety and control devices for gas burners and gas-burning appliances — Particular requirements – Part 6: Thermoelectric flame supervision controls*

ISO 23552-1:2007+AMD 1:2010, *Safety and control devices for gas and/or oil burners and gas and/or oil appliances — Particular requirements — Part 1: Fuel/air ratio controls, electronic type*

ISO 23553-1:2014, *Safety and control devices for oil burners and oil-burning appliances — Particular requirements - Part 1: Automatic and semi-automatic valves*

ISO 23555-2:2022, *Gas pressure safety and control devices for use in gas transmission, distribution and installations for inlet pressures up to and including 10 MPa*

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

IEC 60730-2-5:2013+A1:2017, CSV, *Automatic electrical controls – Part 2-5: Particular requirements for automatic electrical burner control systems*

IEC 60730-2-6:2015+A1:2019, CSV, *Automatic electrical controls – Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*

ASME B1.20.1-2013, *Pipe Threads, General Purpose, Inch*

CAN/CSA-C22.2 No.199-M89:2004, , *Combustion Safety Controls and Solid-State Igniters for Gas- and Oil-Burning Equipment*

CAN/CSA-C22.2 No.60730-2-4-14: 2019, *Automatic electrical controls for household and similar use - Part 2-5: Particular requirements for automatic electrical burner control systems*

CSA/ANSI Z21.18-2019/CSA 6.3-2019, *Gas appliance pressure regulators*

CSA/ANSI Z21.21-19/CSA 6.5-2019, *Automatic valves for gas appliances*

EN 88-1:2016, *Pressure regulators and associated safety devices for gas appliances — Part 1: Pressure regulators for inlet pressures up to and including 50 kPa*

EN 88-2:2015, *Safety and control devices for gas burners and gas burning appliances — Part 2: Pressure regulators for inlet pressure above 50 kPa up to and including 500 kPa and associated safety devices*

EN 88-2:2020, *Pressure regulators and associated safety devices for gas appliances — Part 2: Pressure regulators for inlet pressures above 500 mbar up to and including 5 bar*

EN 88-3:2017, *Safety and control devices for gas burners and gas burning appliances — Part 3: Pressure and/or flow rate regulators for inlet pressures up to and including 500 kPa, electronic types*

EN 125:2010+A1:2015, *Flame supervision devices for gas burning appliances — Thermoelectric flame supervision devices*

EN 161:2013, *Automatic shut-off valves for gas burners and gas appliances*

EN 298:2012, *Automatic burner control systems for burners and appliances burning gaseous or liquid fuels*

EN 331:2015, *Manual operated ball valves and closed bottom taper plug valves for gas installations for buildings*

EN 334:2019, *Gas pressure regulators for inlet pressure up to 100 bar*

EN 1854:2010, *Pressure sensing devices for gas burners and gas burning appliances*

EN 12067-2:2004, *Safety and control devices for burners and appliances burning gaseous or liquid fuels — Control functions in electronic systems — Part 2: Fuel/air ratio control/supervision of the electronic type*

EN 14382:2019, *Gas safety shut-off devices for inlet pressure up to 10 MPa (100 bar)*

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EN 13774:2013, *Valves for gas distribution systems with maximum operating pressure less than or equal to 16 bar - Performance requirements*

EN 16678:2016, *Safety and control devices for gas burners and gas burning appliances — Automatic shut-off valves for operating pressure of above 500 kPa up to and including 6,300 kPa*

EN 60730-2-5:2015+A1:2019, *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems*

EN 60730-2-6:2016+A1:2020, *Standard for automatic electrical controls — Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*

JIS C 9730-2-5:2010, *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems*

UL 372:2012, *Automatic electrical controls for household and similar use — Part 2: Particular requirements for Burner Ignition Systems and Components, 6th Edition*

UL 429:2013, *Standard for Electrically Operated Valves, 7th Edition*

UL 60730-2-5:2014, *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems*

UL 60730-2-6:2016, *Standard for automatic electrical controls – Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010, ISO 13574:2015 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
maximum allowable pressure
maximum pressure for which the equipment or piping system is designed

Note 1 to entry: This definition takes precedence over the definition specified in ISO 13574: 2015, 2.132.

3.2
line-burner
burner where the housing has a linear or grid style geometry typically equipped with multiple nozzles or other elements for introduction of fuel, air or fuel/air-mixtures and creating a linear or grid shape flame pattern by flame propagation from one nozzle/element to another

4 Safety requirements, measures and verification means

4.1 General

4.1.1 Safety objectives and basic requirements

Combustion and fuel handling systems that are part of industrial furnaces and associated processing equipment (TPE), including single and multiple burner systems in thermoprocessing equipment and machines, shall comply with the safety requirements of this document. In addition, the machine shall be designed according to the principles of ISO 12100:2010 for hazards that are relevant, but not significant, and which are not dealt with by this document.

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