



**SLOVENSKI STANDARD**  
**SIST EN 746-2:2000**

**01-april-2000**

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**Industrial thermoprocessing equipment - Part 2: Safety requirements for combustion and fuel handling systems**

Industrial thermoprocessing equipment - Part 2: Safety requirements for combustion and fuel handling systems

Industrielle Thermoprozeßanlagen - Teil 2: Sicherheitsanforderungen an Feuerungen und Brennstoffführungssysteme

Equipements thermiques industriels - Partie 2: Prescriptions de sécurité concernant la combustion et la manutention des combustibles

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25.180.01      Industrijske peči na splošno      Industrial furnaces in general

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EUROPEAN STANDARD

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English version

**Industrial thermoprocessing equipment - Part 2:  
Safety requirements for combustion and fuel  
handling systems**

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

**Contents**

	<b>Page</b>
<b>FOREWORD</b>	<b>3</b>
<b>0 INTRODUCTION</b>	<b>4</b>
<b>1 SCOPE</b>	<b>4</b>
<b>2 NORMATIVE REFERENCES</b>	<b>5</b>
2.1 Group references	5
2.2 Product references	6
<b>3 DEFINITIONS</b>	<b>8</b>
<b>4 LIST OF HAZARDS</b>	<b>14</b>
<b>5 SAFETY REQUIREMENTS, MEASURES AND VERIFICATION MEANS</b>	<b>16</b>
5.1 General	16
5.2 Gaseous fuels	16
5.3 Liquid fuels	31
5.4 Solid fuels	42
5.5 Multiple fuels	48
5.6 Supply of electricity and other utilities	49
<b>6 INFORMATION FOR USE</b>	<b>49</b>
6.1 Marking	49
6.2 Instruction handbook	50
Annex A (informative) - Classification	53
Annex B (informative) - Calculation of the heat input rate	57
Annex C (informative) - Used Definitions	58
Annex ZA (informative) - Clauses of this European Standard addressing essential requirements or other provisions of EU Directives.	73

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)

[SIST EN 746-2:2000](https://standards.iteh.ai/catalog/standards/sist/6cbb7c36-d684-4345-a67d-165b2c9d35e6/sist-en-746-2-2000)

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**FOREWORD**

This European Standard has been prepared by 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 September 1997, and conflicting national standards shall be withdrawn at the latest by September 1997.

The working group that drafted this Part of EN 746 comprised experts from the following countries: Belgium, France, Germany, Italy, Netherlands and the United Kingdom.

This standard forms one part of safety standards covering Industrial Thermoprocessing Equipment.

The full list of parts of this standard is given below:

EN 746 Industrial Thermoprocessing Equipment

Part 1: Common Safety Requirements for Industrial Thermoprocessing Equipment

Part 2: Safety Requirements for Combustion and Fuel Handling Systems

Part 3: Safety Requirements for the Generation and Use of Atmosphere Gases

Part 4: Particular Safety Requirements for Hot Dip Galvanising Thermoprocessing Equipment

Part 5: Particular Safety Requirements for Salt Bath Thermoprocessing Equipment  
[https://standards.iteh.ai/catalog/standards/sist/6cbb7c36-d684-4345-a67d-](https://standards.iteh.ai/catalog/standards/sist/6cbb7c36-d684-4345-a67d-165b2-9d3546/st-en-746-2-1997)

Part 6: Particular Safety Requirements for Material Melting, Remelting and Liquid Phase Maintaining Thermoprocessing Equipment

Part 7: Particular Safety Requirements for Vacuum Thermoprocessing Equipment

Part 8: Particular Safety Requirements for Quenching Equipment

An assessment of the foreseeable risks arising from the use of the equipment covered by this Part of EN 746 was carried during the drafting process.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## 0 INTRODUCTION

This standard has been prepared to be a harmonized standard to provide one means of conforming with the essential safety requirements of the Machinery Directive and associated EFTA Regulations.

The extent to which hazards are covered is indicated in the scope of the standard. In addition, machinery shall comply as appropriate with EN 292 for hazards which are not covered by this standard.

This European standard is a Type C-Standard as defined in EN 292.

The equipment dealt with and the extent to which hazards are covered are indicated in the scope of this Part of EN 746.

This Part of EN 746 assumes that the equipment are operated and maintained by trained personnel.

**Where for clarity an example of a preventative measure is given in the text this should not be considered as the only possible solution. Any other solution leading to the same risk reduction is permissible if an equivalent level of safety is achieved.**

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### 1 SCOPE

This Part of EN 746 applies to all combustion and fuel handling equipment used in industrial thermoprocessing equipment which meets the definition for machinery given in 3.1 of EN 292-1:1991, referred to hereafter as "equipment" e.g. furnaces, kilns, ovens, heating systems such as salt baths and melting tanks, and equipment such as integrated burners and torches used in casting machines, ladle heating etc.

It applies to the handling of fuel immediately adjacent to the equipment but downstream of and including the main plant manually operated fuel shut off valve. It specifies the list of hazards, the safety requirements and associated measures as well as the user instructions relating to fuel handling and combustion equipment.

It applies to all forms of gaseous, liquid and solid fuel and any combinations of them in combustion with air or other gas containing free oxygen.

This Part of EN 746 also applies to gas torches, work station burners, working flame burners and other burners not integral with the plant, even though they are not covered by the mandate.

This Part of EN 746 specifies the requirements to be met by the manufacturer to ensure the safety of persons and property during commissioning, start-up, operation, shut-down and maintenance, as well as in the event of foreseeable faults or malfunctions. It specifies the safety requirements at stages in the life of the equipment, and its design, ordering, construction and use.

The hazards covered by this Part of EN 746 are listed in clause 4.

This Part of EN 746 applies to equipment which is placed on the market after the date of issue of this standard.

This Part of EN 746 does not apply to but may be used as reference for:

- gas torches for welding, flame cutting and related processes;
- boiler installations;
- environmental space heating of any kind;
- the storage of fuel;
- industrial food processing.

## 2 NORMATIVE REFERENCES

This European standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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#### 2.1 Group references (standards.iteh.ai)

EN 292-1:1991	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology
EN 292-2:1991	Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications
EN 60 204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 204-1:1992, modified)
IEC 364-4-41	Electrical installations of buildings; Part 4: Protection for safety; Chapter 41: Protection against electrical shock
IEC 364-4-43	Electrical installations of buildings; Part 4: Protection for safety; Chapter 43: Protection against overcurrent
IEC 364-4-47	Electrical installations of buildings; Part 4: Protection for safety; Chapter 47: Application of protective measures for safety. Section 470 - General. Section 471 - Measures of protection against electric shock

IEC 364-4-442	Electrical installations of buildings; Part 4: Protection for safety; Chapter 44: Protection against overvoltages; Section 442 - Protection of low-voltage installations against faults between high-voltage systems and earth
IEC 364-4-443	Electrical installations of buildings; Part 4: Protection for safety; Chapter 44: Protection against overvoltages; Section 443 - Protection against overvoltages of atmospheric origin or due to switching
IEC 364-4-473	Electrical installations of buildings. Part 4: Protection for safety; Chapter 47: Application of protective measures for safety. Section 473 - Measures of protection against overcurrent
IEC 364-4-45	Electrical installations of buildings. Part 4: Protection for safety; Chapter 45: Protection against undervoltage
IEC 364-4-46	Electrical installations of buildings. Part 4: Protection for safety; Chapter 46: Isolation and switching

## 2.2 Product references

	<a href="https://standards.iteh.ai/catalog/standards/sist/6cbb7c36-d684-4345-a67d-190164550524/EN-746-2-2000">SIST EN 746-2:2000</a>
EN 88	<a href="https://standards.iteh.ai/catalog/standards/sist/6cbb7c36-d684-4345-a67d-190164550524/EN-88">https://standards.iteh.ai/catalog/standards/sist/6cbb7c36-d684-4345-a67d-190164550524/EN-88</a> Pressure governors for gas appliances for inlet pressures up to 200 mbar
EN 125	Flame supervision devices for gas burning appliance - Thermo-electric flame supervision devices
EN 161	Automatic shut-off valves for gas burners and gas appliances
EN 230	Monobloc oil burners - Safety, control and regulation devices and safety times
EN 264	Safety shut-off devices for combustion plants using liquid fuels - Safety requirements and testing
EN 298	Automatic gas burner control systems for gas burners and gas burning appliances with or without fans
prEN 331	Manually operated ball valves and closed bottom taper plug valves for gas installations for buildings



EN 746-1:1997	Industrial thermoprocessing equipment - Part 1: Common safety requirements for industrial thermoprocessing equipment
EN 751	Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water
EN 982	Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics
EN 983	Safety of machinery - Safety requirements for fluid power systems and their components - Pneumatics
prEN 10208-1	Steel pipes for pipe lines for combustible fluids - Technical delivery conditions - Part 1: Pipes of requirement class A
EN 10208-2	Steel pipes for pipelines for combustible fluids - Technical delivery conditions - Part 2: Pipes of requirement class B
prEN 10216-1	Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 1: (Non-alloy steels with specified room temperature properties
prEN 10217-1	Welded steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steels with specified room temperature properties
ENV 10220	Seamless and welded steel tubes - Dimensions and masses per unit length
EN 25817	Arc-welded joints in steel - Guidance on quality levels for imperfections (ISO 5817:1992)
ISO 7-1	Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation
ISO 228-1	Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation
ISO 3405	Petroleum products - Determination of distillation characteristics
ISO 7005-1	Metallic flanges - Part 1: Steel flanges

ISO 7005-2	Metallic flanges - Part 2: Cast iron flanges
ISO 7005-3	Metallic flanges - Part 3: Copper alloy and composite flanges

### 3 DEFINITIONS

For the purposes of this standard, the following definitions apply.

NOTE 1: A classification of plant, fuels and burners is given in Annex A.

NOTE 2: An alphabetic listing of the definitions, as well as their cross-references in German, French and English are given in informative Annex C.

**3.1 air flow detector:** A device for registering the existence of an adequate air flow.

**3.2 air pressure detector:** A device for registering the existence of an adequate air pressure.

**3.3 air-fuel ratio:** The ratio of the mass flow of combustion air to the mass flow of fuel in a mixture.

**3.4 alternating pilot:** A pilot for lighting the main burner that is extinguished at the end of the main burner ignition period and is re-ignited immediately before the main burner is shut down for control purposes.

**3.5 automatic burner:** A burner that is fitted with automatic ignition, a flame safeguard and burner control devices. Ignition, flame monitoring and the on/off operation of the burner occur automatically. The heat input of the burner can be adjusted during operation either automatically or manually.

**3.6 burner:** A combustion system under the control of a single system of safety shut-off valves.

**3.7 burner input rate:** The maximum burner thermal input rate expressed in terms of the net calorific value.

**3.8 by-pass:** A passage conveying fuel from the upstream side to the downstream side of a control so as to be independent of the action of the control.

**3.9 calorific value:** The quantity of heat produced by the combustion of unit volume or mass of fuel at a constant pressure of 1 013 mbar. A distinction is made between the gross calorific value (where the water produced by combustion is assumed to be condensed) and the net calorific value.

**3.10 combustion chamber:** That part of the plant in which the main combustion takes place.

**3.11 condensate drain:** A pipe designed to collect and remove condensate from the low point of a gas circuit.

**3.12 cross-ignited burners:** A group of burners designed such that, by means of their proximity and relative position, ignition of all burners can be ensured should one burner be ignited.

**3.13 enriched air:** Air with an oxygen concentration greater than 21 % (and usually below 27 %) obtained either by the addition of oxygen or the removal of nitrogen.

**3.14 explosion/pressure relief:** A device, e.g. a flange, containing a disc which is designed to yield safely to an abnormal increase of internal pressure

**3.15 extinction safety time:** The period of time that starts with the signal that the flame has been extinguished and ends with the complete shutting off of the fuel supply.

**3.16 filter/strainer; strainer/filter:** A device that enables particles of dirt etc., which could otherwise cause failures in the system, to be collected.

**3.17 flame failure:** The loss of flame from the normally detected position by any cause other than the action of de-energizing the safety shut-off valves

**3.18 flame safeguard:** A device (responsive to flame properties), detecting the presence of a nominated flame and, in the event of ignition failure or subsequent flame failure, causing safety shut-down or lockout.

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It consists of a flame sensor, an amplifier and a relay for signal transmission. These parts, with the possible exception of the actual flame sensor, can be assembled in a single housing for use in conjunction with a programming unit.

**3.19 flame sensor:** The actual flame-sensing element, the output signal value of which is used as the input for the flame safeguard amplifier.

**3.20 flame trap:** A device installed in a pipe conveying gas or a gas-air mixture to arrest the passage of any flame travelling along that pipe.

**3.21 fluidized bed combustor:** A combustion system where fuel is dispersed and burnt in suspension in a moving bed of inert particles. Particle fluidization is maintained by an upward flow of air which also provides the air for combustion.

**3.22 forced draught burner:** A burner in which the combustion air is introduced by means of a fan or blower.

**3.23 gas flow detector:** A device for registering the presence of an adequate gas flow.

**3.24 gas manifold:** A component of the gas distribution system conveying gas to a number of separate burners or injectors.

**3.25 gas pressure detector:** A device for registering the presence of an adequate gas pressure.

**3.26 governor (pressure regulator):** A device which maintains the downstream pressure constant to within fixed limits, independent of variations, within a given range, of the upstream pressure and/or flow rate.

**3.27 graded fuel:** Solid fuel in the form of lumps which are classified according to size.

**3.28 grate burner:** A solid fuel combustion system where the burning fuel is supported on a metallic grate.

**3.29 high temperature equipment** Equipment operating at a temperature above 750 °C at the combustion chamber walls and/or the processing chamber walls.

**3.30 ignition:** The initiation of combustion of a fuel/air mixture by application of a much smaller energy source.

**NOTE:** Where reference is made to combustion air, this also means any gaseous oxidant (e.g. oxygen, oxygen enriched air).

**3.31 ignition burner:** A burner whose flame is intended to ignite another burner.

**3.32 ignition safety time:** The period of time that starts with the opening of the fuel supply during the start-up process and ends, in the absence of a flame, with the shutting off of the fuel supply.

**3.33 induced draught burner:** A burner in which the combustion air is introduced by providing a suction in the combustion chamber by mechanical means, usually a fan.

**3.34 initial boiling point:** The thermometer reading that is observed at the instant that the first drop of condensate falls from the lower end of the condenser tube (see ISO 3405).

**3.35 isolating flange (blanking plate):** A sealing plate that is fitted in place of any fuel-carrying component that has been removed from a fuel circuit.

**3.36 leak tightness device:** A system to prove the effective closure of the start fuel or main fuel safety shut-off valves, and which is capable of:

- a) detecting small fuel leakage rates, e.g. a pressure proving system;
- b) venting safely small leakage rates, e.g. two safety shut-off valves in series, fitted with proof of closure switches to close the fuel line, and a third valve fitted with a switch to prove that it is open, to vent safely the space between them.

**3.37 light back:** The unintended movement of the flame front to a point upstream of its normal operating position.

**3.38 lighting torch:** A hand-held burner which is used to light another burner.

**3.39 liquefied petroleum gas (LPG):** Commercial butane or commercial propane or any mixtures thereof.

**3.40 lock-out:** Automatic shut-off of the fuel supply to the burner which can only be relieved by manual intervention.

**3.41 low temperature plant:** Plant operating at a temperature up to 750 °C at the combustion chamber walls and/or the processing chamber walls.

**3.42 lower flammable limit:** The lowest concentration of fuel in air at which the air/fuel mixture is flammable.

**3.43 main flame:** A flame, other than the start-rate flame, on the main burner.

**3.44 main flame establishment period:** A period during which the main fuel safety shut-off valve(s) is/are permitted to be open before the pilot flame is extinguished and before the flame safeguard is required to supervise the main flame alone.

**3.45 main fuel supply:** Fuel that is supplied to establish and maintain the main flame.

**3.46 manual burner:** A burner in which all the operating sequences are performed by an operator.

iTeh STANDARD PREVIEW

**3.47 manual isolating valve:** A manually operated valve which is upstream of all other fuel controls to that plant and by means of which the fuel supply to the plant can be shut off.

SIST EN 746-2:2000

**3.48 manual shut-off valve:** A manually operated valve by means of which the fuel supply to an individual burner or to a group of burners can be shut off.

**3.49 mixing machine:** A machine that induces a mixture of gas and air, in a ratio determined by an adjustor, for supplying to a burner or burners.

**3.50 multiple burners:** A group of burners, usually of low thermal input, heating a single item of equipment or a single zone.

**3.51 natural draught burner:** A burner in which the combustion air is entrained at atmospheric pressure.

**3.52 non-return valve:** A device to prevent the reversal of flow of air, fuel, oxygen etc.

**3.53 open firing burner:** Torches, work station burners, equipment-integrated burners, and other burners firing in the open and not requiring an enclosed combustion chamber.

**3.54 operating temperature:** The temperature, or range of temperatures, at which the plant is designed to operate.

**3.55 operator supervision:** A circumstance by which an operator has continuous control and surveillance of the plant and is located in a position where he can shut the plant down in the event of an emergency.

**3.56 permanent pilot:** A pilot that is intended to be left permanently alight and which is controlled independently of the main burner.

**3.57 pilot burner:** An ignition burner which is separate from, and controlled independently of, the main burner for which it is the source of ignition.

**3.58 pilot flame:** Pilot burner flame that is used to ignite the main flame.

**3.59 pipework:** All components forming the route by which fuel, air, and oxygen pass from the point of supply to the burner(s).

**3.60 portable burner:** A burner designed to be capable of being fired in different locations.

**3.61 pre-purge:** The introduction of air or inert gas into the combustion chamber and flue passages in order to displace any fuel/air mixture which remains there.

**3.62 pressure relief valve:** A valve or regulator designed to protect a system against excessive pressure. Its function is to vent to a safe place when a pre-determined pressure is reached.

**3.63 processing chamber:** That part of the equipment in which the workpiece(s) being processed is/are contained.

**3.64 proof of closure switch:** A switch fitted to a safety shut-off valve with mechanical overtravel which proves the valve to be in the closed position.

**3.65 pulse firing:** A multiple burner combustion system where the firing rate is controlled by the number and/or duration of burners firing at two fixed heat input rates, e.g. high/low or on/off.

**3.66 pulverized fuel:** Solid fuel which has been ground to a powder.

**3.67 purge:** The displacement of air by inert gas or fuel, and vice versa, from pipework during initial commissioning, following prolonged shut-down, after carrying out work on the fuel distribution system and during de-commissioning.

**3.68 purge point:** A small bore plugged tapping at the extremities of a fuel distribution system to facilitate purging.

**3.69 re-cycling:** The process by which, after a safety shut-down, a full start-up sequence is automatically repeated.

**3.70 safety shut-down:** The process which is initiated immediately in response to the signal from a limiting device or sensor and which causes the burner to shut-down in the same way as for a controlled shut-down.

**3.71 safety shut-off system:** A system of safety shut-off valves with associated control circuits that enables the supply of fuel to the burner to be admitted or shut-off.

- 3.72 safety shut-off valve:** A valve designed to open when energized and to close automatically when de-energized.
- 3.73 self-checking flame safeguard:** A flame safeguard having an internal function which automatically checks its operation.
- 3.74 spark restoration:** The process by which, following loss of flame signal, the ignition device will be switched on again without total interruption of the fuel supply.
- 3.75 start fuel:** Fuel admitted to the pilot or to the main burner at low rate prior to the establishment of the main flame.
- 3.76 start fuel flame:** A flame established at the start fuel rate either at the main burner or at a separate pilot burner.
- 3.77 start fuel flame establishment:** The establishment of a proved and supervised start fuel flame.
- 3.78 start fuel flow rate:** The fuel flow rate ignited by the ignition device during the start-up of the burner.
- 3.79 start fuel supply:** Fuel that is supplied at the start fuel rate to establish the start fuel flame.
- 3.80 stoichiometric fuel rate:** That fuel rate at which, if reacted completely with the combustion air flow, the fuel would just consume all the oxygen in the air.  
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- 3.81 strainer/filter; filter/strainer:** See 3.16 filter/strainer.
- 3.82 test pressure:** That pressure to which pipework is subjected as a check for soundness.
- 3.83 thermo-processing equipment:** Equipment in which material or a workpiece is subjected to thermal energy.
- 3.84 torch:** Any manually controlled gas- or oil-fired open-flame tool or any mobile burner unit firing in the open.
- 3.85 Wobbe index:** The ratio of the calorific value of a gas per unit volume to the square root of its density relative to air.
- The Wobbe index is said to be gross or net depending on whether the calorific value used is the gross or net calorific value.
- 3.86 work station burner:** A burner used at a particular work station and firing in the open rather than into a closed combustion chamber.
- 3.87 zone:** A self-contained space within a equipment which is operating under the same parameters (e.g. temperature, pressure).