
Industrijska termoprocesna oprema - 1. del: Splošne varnostne zahteve za industrijsko termoprocesno opremo

Industrial thermoprocessing equipment - Part 1: Common safety requirements for industrial thermoprocessing equipment

Industrielle Thermoprozessanlagen - Teil 1: Allgemeine Sicherheitsanforderungen an industrielle Thermoprozessanlagen

Equipements thermiques industriels - Partie 1: Prescriptions générales de sécurité pour les équipements thermiques industriels

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25.180.01 Qã•dã\^Á^ ãäÄ [[z] [Industrial furnaces in general

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Industrial thermoprocessing equipment - Part 1: Common safety requirements for industrial thermoprocessing equipment

Equipements thermiques industriels - Partie 1:
Prescriptions générales de sécurité pour les équipements
thermiques industriels

Industrielle Thermoprozessanlagen - Teil 1: Allgemeine
Sicherheitsanforderungen an industrielle
Thermoprozessanlagen

This European Standard was approved by CEN on 15 February 1997 and includes Amendment 1 approved by CEN on 16 July 2009.

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




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Foreword

This document (EN 746-1:1997+A1:2009) 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of an identical text or by endorsement, at the latest by February 2010, and conflicting national standards shall be withdrawn at the latest by February 2010.

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

This document includes Amendment 1, approved by CEN on 2009-07-16.

This document supersedes EN 746-1:1997.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

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

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

The full list of parts of EN 746 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

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

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).

A1 For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. **A1**

An assessment of the foreseeable risks arising from the use of the equipment was carried out when this standard was prepared.

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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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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Introduction

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



The extent to which hazards are covered is indicated in the scope of this standard. In addition, machinery shall comply as appropriate with  EN ISO 12100  for hazards which are not covered by this standard.

This European Standard is a type-C standard as defined in  EN ISO 12100 .

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.

This part of EN 746 assumes that the installations are operated and maintained by trained personnel.

1 Scope

1.1 This part of EN 746 specifies common safety requirements for industrial thermoprocessing equipment (for example industrial furnaces and industrial heating equipment), which meets the definition for machinery given in  EN ISO 12100-1:2003 .

It details the anticipated significant hazards associated with industrial thermoprocessing equipment and specifies the appropriate preventative measures for reduction or elimination of these hazards.

This standard gives general principles and common requirements for the reduction of risks for equipments covered by the scope.

The common requirements apply to all of the subsequent parts of this EN 746 dealing with specific equipment unless an exception is stated in the relevant Part. The general principles (subclauses are pointed out) will be used to establish the specific technical measures in the subsequent Part(s) dealing with safety requirements for particular equipment.

NOTE For similar equipment not covered by the particular Parts of this standard, EN 746-1 can be used to assist in the reduction of risk for the Hazards identified in clause 4 (List of Hazards).

1.2 This part of EN 746 is applicable to industrial thermoprocessing equipments for use in fields such as:

- Metallurgical and metal working plant;
- Glass making plant;
- Ceramic manufacturing plant;
- Cement, lime and gypsum manufacturing plant;
- Chemical plant;
- Waste incineration equipment;

And heated by:

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- Gaseous fuels;
- Liquid fuels;
- Solid fuels;
- Mixed fuels;
- Electricity.

The thermoprocessing equipment covered by this Part of EN 746 is further specified in clause 3.

A more detailed list of thermoprocessing equipment within these categories is given in Annex A.

In the remainder of this standard the expression "equipment" will be used.

This Part of EN 746 is not applicable to blast furnaces, converters (in steel plants), boilers, welding machines or food processing equipment.

1.3 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, maintenance periods and dismantling, as well as in the event of foreseeable faults or malfunctions which can occur in the equipment.

It specifies the safety requirements at stages in the life of the equipment, and its design, ordering, construction, use and disposal.

It specifies safety requirements for:

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Protection against:

- Mechanical hazards, movement of machinery and material, ejection of parts or material or liquids and gases, implosion, structural failure;
- Electrical hazards;
- Thermal hazards: explosion, fire, scalds, contact with hot parts, gases and flames;
- Noise and vibration;
- Thermal, optical and ionising and non-ionising radiation;
- Harmful by-products and hazardous substances, poisoning, biological and microbiological contamination, pollution and environmental discomfort;
- Other hazards such as listed in clause 4;

maintenance, provision for indicators, and inspection.

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

2 Normative references

^{A1} The following referenced documents are indispensable for the application 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. ^{A1}

2.1 Basic Standards

^{A1} deleted text ^{A1}

EN 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

^{A1} IEC 60364-4-41, *Low-voltage electrical installations — Part 4-41: Protection for safety — Protection against electric shock* ^{A1}

^{A1} IEC 60364-4-43, *Electrical installations of buildings — Part 4-43: Protection for safety — Protection against overcurrent* ^{A1}

^{A1} deleted text ^{A1}

^{A1} IEC 60364-4-44, *Low-voltage electrical installations — Part 4-44: Protection for safety — Protection against voltage disturbances and electromagnetic disturbances* ^{A1}

^{A1} deleted text ^{A1}

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2.2 Group Safety Standards

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EN 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

^{A1} deleted text ^{A1}

EN 547-1, *Safety of machinery — Human body measurements — Part 1: Principles for determining the dimensions required for openings for whole body access into machinery*

EN 547-2, *Safety of machinery — Human body measurements — Part 2: Principles for determining the dimensions required for access openings*

^{A1} deleted text ^{A1}

EN 614-1, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 626-1, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*

^{A1} deleted text ^{A1}

EN 842, *Safety of machinery — Visual danger signals — General requirements, design and testing*

^{A1} EN 953, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards* ^{A1}

^{A1} deleted text ^{A1}

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EN 981, *Safety of machinery — System of auditory and visual danger and information signals*

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*

EN 1037, *Safety of machinery — Prevention of unexpected start-up*

EN 1088, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1127-1, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 1299, *Mechanical vibration and shock — Vibration isolation of machines — Information for the application of source isolation*

EN ISO 11690-2, *Acoustics — Recommended practice for the design of low-noise workplaces containing machinery — Part 2: Noise control measures (ISO 11690-2:1996)*

EN 60825-1, *Safety of laser products — Part 1: Equipment classification and requirements (IEC 60825-1:2007)*

EN 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:2007)*

EN 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking (IEC 61310-2:2007)*

EN ISO 7731, *Ergonomics — Danger signals for public and work areas — Auditory danger signals (ISO 7731:2003)*

EN ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

EN ISO 13850, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

EN ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

IEC 60405, *Nuclear instrumentation — Constructional requirements and classification of radiometric gauges*

IEC 60417-DB, *Graphical symbols for use on equipment*

ISO 7000, *Graphical symbols for use on equipment — Index and synopsis*

ISO 7243, *Hot environments — Estimation of the heat stress on working man, based on the WBGT-index (wet bulb globe temperature)*

ISO 7933, *Hot environments — Analytical determination and interpretation of thermal stress using calculation of required sweat rate*

2.3 Product Safety Standards

EN 746-2:1997, *Industrial thermoprocessing equipment — Part 2: Safety requirements for combustion and fuel handling systems*

EN 746-3, *Industrial thermoprocessing equipment — Part 3: Safety requirements for the generation and use of atmosphere gases*

EN 746-4, *Industrial thermoprocessing equipment — Part 4: Particular safety requirements for hot dip galvanising thermoprocessing equipment*

EN 746-5, *Industrial thermoprocessing equipment — Part 5: Particular safety requirements for salt bath thermoprocessing equipment*

prEN 746-6, *Industrial thermoprocessing equipment — Part 6: Particular Safety Requirements for Liquid Phase Treatment Equipment*

prEN 746-7, *Industrial thermoprocessing equipment — Part 7: Particular Safety Requirements for Vacuum Thermoprocessing Equipment*

EN 746-8, *Industrial thermoprocessing equipment — Part 8: Particular safety requirements for quenching equipment*

EN 1547, *Industrial thermoprocessing equipment — Noise test code for industrial thermoprocessing equipment including its ancillary handling equipment*

EN 60519-1, *Safety in electroheat installations — Part 1: General requirements* (IEC 60519-1:2003)

EN 60519-2, *Safety in electroheat installations — Part 2: Particular requirements for resistance heating equipment* (IEC 60519-2:2006)

EN 60519-3, *Safety in electroheat installations — Part 3: Particular requirements for induction and conduction heating and induction melting installations* (IEC 60519-3:2005)

EN 60519-4, *Safety in electroheat installations — Part 4: Particular requirements for arc furnace installations* (IEC 60519-4:2006)

IEC/TS 60519-5, *Safety in electroheat installations — Part 5: Specifications for safety in plasma installations*

EN 60519-6, *Safety in electroheat installations — Part 6: Specifications for safety in industrial microwave heating equipment* (IEC 60519-6:2002)

IEC 60519-7, *Safety in electroheat installations — Part 7: Particular requirements for installations with electron guns*

EN 60519-8, *Safety in electroheat installations — Part 8: Particular requirements for electrosag remelting furnaces* (IEC 60519-8:2005)

EN 60519-9, *Safety in electroheat installations — Part 9: Particular requirements for high-frequency dielectric heating installations* (IEC 60519-9:2005)

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3 Definitions

For the purposes of this standard the following definitions apply:

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

3.1

metallurgical and metal working plant

plant and/or equipment which is used for thermal production, melting or remelting of ferrous and non-ferrous metals as well as to enable the molten material to be held, heated, alloyed and restructured before recasting into predetermined shapes.

Equipment used to remelt and re-alloy selected scrap material to produce primary ingots for remelting.

Equipment used to change the structure of the solid material by heating and cooling through various temperature gradient changes before its return to ambient temperature.

Equipment used to pre-heat metal prior to mechanical working or joining.

3.2

glass making plant

plant and/or equipment which is used to heat and melt the constituents which make up glass and to allow for their proper mixing before the molten material is used directly to manufacture glass products.

Plant and/or equipment which is used for heat treatment or forming of glass products.

3.3

ceramic manufacturing plant

plant and/or equipment which is used for firing, heating and/or melting ceramic raw material and/or products (e.g. tiles, sanitary ware, table ware, bricks) to process the product to its intermediate or final state.

Plant and/or equipment for the reheating and drying of such products to apply glaze and other decoration to the item.

3.4

cement, lime and gypsum manufacturing plant

plant and/or equipment used to calcine and/or fire selected raw materials to produce cement, lime and gypsum.

3.5

chemical plant

plant and/or equipment which provides the heat input into chemical plants used in processes such as thermo-chemical reactions, oxygenation, catalysing, reduction, chain reactions and distillation.

3.6

waste incineration equipment

equipment used to dispose of by burning, household and industrial waste, sewage sludge, tyres, special and toxic waste, medical and hospital waste but excluding atomic waste.

3.7

drying equipment

equipment used to cure or expel moisture or volatiles from a product or material by heating.

3.8

cooling equipment

equipment with heating and/or cooling systems used to reduce the temperature of products.

4 List of Hazards

Anticipated significant hazards are listed in broad outline in the scope and are detailed in Table 1.

For ease of reference table 1 also indicates the corresponding preventative measures and should be used in conjunction with clauses 5 and 6.

Table 1 — List of Hazards, Hazardous Situations and Preventative Measures

NOTE When personal protective equipment is referred to, the manufacturer should recommend it in the information for use manual

1 Clause	2 Hazard	3 Hazardous Situation	4 Preventative Measures	5 References
1	GENERAL		General design concept (Structure, access for operation, maintenance and cleaning, lighting, etc.)	5.1.1 to 5.1.3
2	MECHANICAL			
2.1	General		Design, structural details	5.2.1
2.2	Crushing	Moving parts Traps created by auto and manual feeding/take-off mechanisms	Emergency stops; Guards Fit guard, fit interlocks, Means of warning (audible, visual), Provision of safety distances, Provision of warning signs, Emergency stops, Push button with visual inspection, Maintenance/cleaning, good practice (particularly on guards). Fit guard,	5.2.2, ^{A1} EN ISO 13850 ^{A1} , ^{A1} EN 953 ^{A1} 5.2.2, ^{A1} EN 953 ^{A1} . prEN 1088 ^{A1} EN ISO 7731 ^{A1} , prEN 842, EN 981, EN 61310-1 ^{A1} EN ISO 13857 ^{A1} ; EN 349; ^{A1} <i>deleted text</i> ^{A1} ; EN 547-1 ISO 7000; EN 61310-1 ^{A1} EN ISO 13850 ^{A1}
2.3	Shearing	Moving parts, moving of charging doors, feeding/take-off mechanism	Fit interlocks,	5.2.3; ^{A1} EN 953 ^{A1} prEN 1088,

(continued)

Table 1: (continued)

1 Clause	2 Hazard	3 Hazardous Situation	4 Preventative Measures	5 References
			Means of warning (audible, visual),	EN ISO 7731 ^(A1) , prEN 842, EN 61310-1, EN 981
			Provision of warning signs,	ISO 7000, EN 61310-1
			Safety distances, Perimeter fencing, marking, Push button with visual inspection.	EN 349, EN 547-1
2.4	Entanglement	Rotating shafts (e.g. fan shafts, conveyors, transmission machinery)	Guards	EN 953 ^(A1) 5.2.4
2.5	Drawing-in	Nips created by rolls (e.g. conveyors)	Guards	EN 953 ^(A1) 5.2.5
2.6	Impact	Struck by moving parts (e.g. doors, chargers)	Guards, Perimeter fencing systems or signs	EN 953 ^(A1) 5.2.6
2.7	High pressure fluids	Hydraulic leaks/failure Steam and service fluids	Prevent as far as possible by adopting good maintenance procedures. Design features; Guards.	5.2.7 prEN 982, prEN 983 EN 953 ^(A1)
2.8	Ejection of parts	Molten metal, Process components/materials, Machinery parts	Containing and draining. Effective protection of defined areas or sections; Provision of personal protective equipment Guarding, Design features, Method of operation	5.2.8 6.4.15 EN 953 ^(A1)
2.9	Implosion	Ejection of parts	Design features; method of operation	5.2.9 prEN 746-7
2.10	Stability	Collapsing of parts or equipment or materials; Movement of components or of machinery	Design (e.g. civil engineering) and maintenance; Design, training, understanding of the system, signs	5.2.10 ISO 7000, EN 61310-1

(continued)

Table 1: (continued)

1 Clause	2 Hazard	3 Hazardous Situation	4 Preventative Measures	5 References
2.11	Slip/trip	Floor surfaces, Walkway surfaces,	Ladders, walkways designed in accordance with defined specifications: no trip conditions; easy to maintain and clean; good maintenance and cleaning.	5.2.11
2.12	Falls	Spilled fluids, Inadequate lighting. 1 – From equipment; 2 – Into equipment (e.g. openings, charging); 3 – Inadequate lighting	Provide containment and draining; Provide adequate lighting Ensure openings are covered or guarded Provide adequate hand holds; Flat safe surrounding floors; Ensure openings closed during normal operation; Provide adequate lighting	5.2.12
3	ELECTRICAL			
3.1	General		<p>– For electroheat installations, design and operation to be in accordance with EN 60519-1, EN 60519-2, and other parts of IEC 519</p> <p>– For all other thermoproc. equipment: design and operation in accordance with [A1] IEC 60364-4-41 [A1], [A1] IEC 60364-4-43 [A1], [A1] deleted text [A1], [A1] IEC 60364-4-44 [A1], [A1] deleted text [A1], [A1] deleted text [A1], [A1] deleted text [A1], [A1] IEC 60364-4-44 [A1], [A1] deleted text [A1], [A1] deleted text [A1], [A1] deleted text [A1] and EN 60204-1.</p>	<p>5.3.1 EN 60519-1; EN 60519-2, [A1] EN 60519/IEC 60519 Parts 3 to 9 [A1]</p> <p>[A1] IEC 60364-4-41 [A1], [A1] IEC 60364-4-43 [A1], [A1] deleted text [A1], [A1] IEC 60364-4-44 [A1], [A1] deleted text [A1], [A1] deleted text [A1], [A1] deleted text [A1], and EN 60204-1</p>
3.2 3.2.1	Contact Direct	Exposed or accessible live connectors, bus bars, etc.	<p>Appropriate protection (fixed/interlocking guards), locked control cabinets, safety audit, enclosed electrical control and supply rooms</p> <p>– For electroheat installations: see EN 60519-1, EN 60519-2, [A1] EN 60519-3 [A1] and following parts;</p>	<p>5.3.2 [A1] EN 953 [A1] prEN 1088</p> <p>EN 60519-1 EN 60519-2 [A1] EN 60519/IEC 60519 Parts 3 to 9 [A1]</p>

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