



**SLOVENSKI STANDARD**  
**SIST EN 746-4:2000**  
**01-april-2000**

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**Industrial thermoprocessing equipment - Part 4: Particular safety requirements for hot dip galvanising thermoprocessing equipment**

Industrial thermoprocessing equipment - Part 4: Particular safety requirements for hot dip galvanising thermoprocessing equipment

Industrielle Thermoprozeßanlagen - Teil 4: Besondere Sicherheitsanforderungen an Feuerverzinkungsanlagen

Equipements thermiques industriels - Partie 4: Prescriptions particulieres de sécurité pour les équipements thermiques de galvanisation a chaud

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**Ta slovenski standard je istoveten z: EN 746-4:2000**

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**ICS:**

25.180.01 Industrial furnaces in general

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**en**

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English version

Industrial thermoprocessing equipment - Part 4: Particular safety requirements for hot dip galvanising thermoprocessing equipment

Équipements thermiques industriels - Partie 4: Prescriptions particulières de sécurité pour les équipements thermiques de galvanisation à chaud

Industrielle Thermoprozeßanlagen - Teil 4: Besondere Sicherheitsanforderungen an Feuerverzinkungsanlagen

This European Standard was approved by CEN on 22 November 1999.

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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 Central Secretariat has the same status as the official versions.

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

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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of an identical text or by endorsement, at the latest by July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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

The annexes A and ZA are informative.

## 0 INTRODUCTION

The EN 746-1 “General Safety Requirements” contains the common safety provisions and devices for all types of industrial thermoprocessing equipment. This part of the standard details in addition those extra safety requirements which need special attention against the equipment listed in the scope.

This European Standard is a type C standard as defined in EN 292:1991.

The extent to which hazards are covered is indicated in the scope of this standard.

## 1 SCOPE

This part of EN 746 gives the specific hazards and safety requirements that shall be provided by the manufacturer for Hot Dip Industrial Batch and the Bath of Continuous Galvanising Thermoprocessing Equipment, whether it is used as an independent unit or an integrated part of a plant.

This part of EN 746 does not deal with the risks arising from any component handling equipment for the dip process or for the associated protective measures.

This part of EN 746 does not cover the handling, storage, transport, disposal, transfer or regeneration of the zinc and the processed material outside the limits of the equipment.

This part of EN 746 applies not only to the normal operation of the equipment but also to the safety of personnel and property in the event of abnormal operation and when foreseeable faults occur.

Examples of hot dip galvanising equipment are shown in Fig. 1 and Fig. 2.

NOTE: There are many variations in the design of galvanising equipment. Only two examples of the various types are given in this text.

## 2 NORMATIVE REFERENCES

This European Standard incorporates by dated or undated references, 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.



EN 137	Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus. Requirements, testing, marking.
EN 166	Personal eye-protection - Specifications
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 345	Specification for safety footwear for professional use
EN 346	Specification for protective footwear for professional use
EN 469	Protective clothing for firefighters - Requirements and test methods for protective clothing for firefighting
EN 531	Protective clothing for industrial workers exposed to heat (excluding fire fighters' and welders' clothing)
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 746-1:1997	Industrial Thermoprocessing Equipment - Part 1: Common Safety Requirements for Industrial Thermoprocessing Equipment
EN 746-2	Industrial Thermoprocessing Equipment - Part 2: Safety Requirements for Combustion and Fuel Handling Systems
prEN 1005-2:1998	Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and component parts of machinery
prEN 1005-3:1998	Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation
EN 1070	Safety of machinery - Terminology
EN 1093-4	Safety of machinery - Evaluation of the emission of airborne hazardous substances - Part 4: Capture efficiency of an exhaust system - Tracer method
prEN 1248:1998	Foundry machinery - Safety requirements for abrasive blasting equipment
EN 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:1997)
EN 61310-1	Safety of machinery - Indication, marking and actuation - Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995)

### 3 DEFINITIONS

For the purposes of this standard the definitions given in EN 1070 apply.  
Additional definitions specifically needed for this standard are added below:

#### 3.1 Hot Dip Galvanising Equipment

##### 3.1.1 Batch process

Equipment which melts and/or contains zinc or zinc alloy into which metallic components are dipped or immersed for a predetermined time interval to coat them partially or fully in zinc or zinc alloy.

This equipment may include for example:

- mechanical handling systems;
- heating systems;
- cooling systems;
- environmental control systems;
- electrical and control systems.

##### 3.1.2 Kettle

Container for the galvanising material.

##### 3.1.3 Double Dipping

Process whereby the component is immersed twice into the bath.

#### 3.2 Components

##### 3.2.1 Batch process

Discrete workpieces which are immersed in the zinc/zinc alloy.

##### 3.2.2 Dip process

Wire, strip or similar continuous material which is processed through the zinc/zinc alloy bath.

### 4 LIST OF HAZARDS

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An assessment of the foreseeable risks arising from the use of the industrial thermoprocessing equipment has been carried out when this standard was elaborated.

The clause has been condensed into a table (see table 1). It summarises those areas which require consideration by the manufacturer. For ease of reference the table indicates the need for safety features or instructions in columns. The table shall only be used in conjunction with clauses 5 and 7 where further detail is given.

Table 1 shows the Hazard, Hazardous Situation and Preventative Measures and Verification Means identified for the equipment type described in this part to this standard.



**Table 1:  
List of Hazards, Hazardous Situations and Preventative Measures**

1 Item	2 Hazard	3 Hazardous situations	4 Preventative measures	5 Re- ferences	6 Verifi- cation means*)
<b>1</b>	<b>Mechanical - applies to batch and dip processes</b>				
1.1	Crushing/ shearing	Accidental descent of the charging equipment	1 Provide safety device(s) for interrupting the movement of the charging equipment when failure of the equipment occurs  2 Provide a device on the rope that prevents the rope loosening  3 Any manual control in use shall be designed to override any linked automatic control	EN 746-1:1997, 5.2.2 EN 60204-1 EN 292-2:1991, 3.7.8 d) + e)  EN 746-4:2000, 5.2  prEN 1248:1998, Part 3	1 and 2  1  1
1.2		Breakage of lifting chain, rope or auxiliary equipment	1 Provide suitable screens  2 Appropriate slinging methods	7.2.1 (d) 5.2 7.2.5	1  1
<b>2</b>	<b>Thermal</b>				
2.1		Accidental introduction or accidental spillage of liquids in or onto the liquid bath  Ejection of molten metal from evolution of steam or gases	The instruction handbook should include the following suggestions:  1 Personal Protection Equipment provision  2 Correct fire extinguishers  3 Provision of warning signs When the process requires it, measures can include:  1 Operation systems to include drying of components  2 Training of operators	5.2  7.2.2 7.2.3 (a) 7.2.1  7.1  7.1	1  1  1  1

(continued)

\*) see Note to clause 6 for explanation of numbers

**Table 1: (continued)**

1 Item	2 Hazard	3 Hazardous situations	4 Preventative measures	5 Re- ferences	6 Verifi- cation means
2.2		Accidental introduction of gases into the bath by liquid or dragged into the bath by components.  Ejection of molten metal from bath	The instruction handbook should include the following suggestions:  1 Component design 2 Training of operators 3 Personal Protection Equipment provision 4 Correct fire extinguishers	5.2  7.1 7.1 7.2.2 7.2.3 (a)	  1 1 1 1
2.3		Overflow or spillage of molten metal	The instruction handbook should include the following suggestions:  1 Training of personnel 2 Personal Protective Equipment provision 3 Maintenance/housekeeping 4 Observation of level and volume of component to be charged	5.3  7.1 7.2.2 7.2.4 7.1	  1 1 1 1
2.4		Losses due to leakage of molten zinc through breakage of bath container	Instruction handbook:  1 Maintenance/housekeeping 2 Regular check of bath for condition 3 Where necessary provide protection with barriers or screens	5.3  7.2.4 Table 2 7.2.1	  1 2 1 and 2
2.5		Falling into molten metal	Design, particularly charging area (e.g. barriers, safe guards)  2 Provision of warning signs  The instruction handbook should include the following suggestions:  Personal Protection Equipment (e.g. non-slip foot wear)	5.6  7.2.1  7.2.2	  1 1 1

(continued)

**Table 1: (concluded)**

1 Item	2 Hazard	3 Hazardous situations	4 Preventative measures	5 Re- ferences	6 Verifi- cation means
2.6		Breakage of protection tube(s) of thermocouple(s) internal and/or external  Zinc and/or zinc alloy overheats  Reaction between the material of the kettle and the molten zinc or zinc alloy leading to leakage	Design to ensure fail safe conditions prevail or provide automatic shut down devices  The instruction handbook should include the following suggestions:  1 Training of operators  2 Maintenance/ houskeeping	5.4    7.1  7.2.4	1    1  1
<b>3</b>	<b>Materials and Substances</b>				
3.1		Inhalation of fumes	1 Design  2 Provide an effective ventilation system  3 Personal Protective Equipment provision  4 Maintenance/ housekeeping  5 Training of personnel	5.5  5.5  7.2.2  7.2.4  7.1	1  1 and 2  1  1  1
<b>4</b>	<b>Neglecting ergonomic principles</b>				
4.1		Unhealthy posture or excessive efforts causing impaired judgement or poor visibility during charging or discharging	The equipment shall be designed in such a way that there is no hindrance to technical aids and possibility for good working postures	5.7	1 and 2

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