



SLOVENSKI STANDARD
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Glavni namen tega standarda je zagotoviti varnost pri uporabi strojev za izdelavo prednapetih izdelkov iz betona in kalcijevega silicata - varnost - del 7: Stacionarna in mobilna oprema za dolga vrzeta izdelave prednapetih izdelkov.

Machines for the manufacture of constructional products from concrete and calcium-silicate - Safety - Part 7: Stationary and mobile equipment for long line manufacture of prestressed products

STANDARD PREVIEW

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Maschinen für die Herstellung von Bauprodukten aus Beton und Kalksandsteinmassen - Sicherheit - Teil 7: Stationäre und fahrbare Einrichtungen für die Herstellung von Spannbetonelementen

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Machines pour la fabrication de produits de construction en béton et silico-calcaire - Sécurité - Partie 7: Equipements fixes et mobiles pour la fabrication sur bancs de produits en béton précontraint

Ta slovenski standard je istoveten z: EN 12629-7:2004

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ICS 91.220

English version

Machines for the manufacture of constructional products from
concrete and calcium-silicate - Safety - Part 7: Stationary and
mobile equipment for long line manufacture of prestressed
products

Machines pour la fabrication de produits de construction en
béton et silico-calcaire - Sécurité - Partie 7: Equipements
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Maschinen für die Herstellung von Bauprodukten aus Beton
und Kalksandsteinmassen - Sicherheit - Teil 7: Stationäre
und fahrbare Einrichtungen für die Herstellung von
Spannbetonelementen

This European Standard was approved by CEN on 3 November 2003.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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Foreword

This document (EN 12629-7:2004) has been prepared by Technical Committee CEN/TC 151 "Construction equipment and building material machines — 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 August 2004, and conflicting national standards shall be withdrawn at the latest by August 2004.

This document 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 document.

Annexes A, B, C, D, E, F, G and H are informative.

The series "Machines for the manufacture of constructional products from concrete and calcium-silicate — Safety" consists of following parts:

- Part 1: Common requirements;
- Part 2: Block making machines;
- Part 3: Slide and turntable machines;
- Part 4: Concrete roof tile making machines;
- Part 5: Pipe making machines;
- Part 6: Stationary and mobile equipment for the manufacture of precast reinforced products;
- Part 7: Stationary and mobile equipment for long line manufacture of pre-stressed products;
- Part 8: Machines and equipment for the manufacture of constructional products from calcium silicate (and concrete).

This document is complementary to part 1 and is intended to be used in combination with that part.

Annex A is informative and contains "Pre-stressing bed", annex B is informative and contains "Bed sweeper, vacuum cleaner, oiler, wire-guide machine", annex C is informative and contains "Bed layout machine", annex D is informative and contains "Strand pushing/pulling machine", annex E is informative and contains "Vibrodistributor, spinner, extruder", annex F is informative and contains "Tarpaulin paying out and winding in machine", annex G is informative and contains "Sawing machine".

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard is a Type C standard as stated in EN 1070.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this European Standard.

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

This European Standard specifies the additional requirements to and/or the deviations from EN 12629-1 specific for the Stationary and mobile equipment for long line manufacture of pre-stressed products as defined in clause 3.

With the aim of clarifying the intentions of the standard it should be noticed that the following assumptions were made when producing it:

- specific conditions of use or environmental conditions out of the scope of the standard shall be the subject of negotiations between the manufacturer and the user/owner;
- the equipment will only be used by competent and designated persons;
- the place of use/installation is adequately lit;
- All operations are carried out by specially trained operators.

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1 Scope

1.1 This European Standard is intended to be used together with EN 12629-1 "*Machines for the manufacture of constructional products from concrete and calcium-silicate — Safety — Part 1: Common requirements*", which specifies general requirements of machines for the manufacture of constructional products from concrete and calcium-silicate.

The manufacturing bed is a machine with which other associated machines work simultaneously. Moreover, these machines are generally used on beds installed in parallel.

1.2 This standard gives particular requirements for the design of the following machines:

- Pre-stressing bed (schematic representation is given in annex A);
- Bed sweeper, vacuum cleaner, oiler, wire-guide machine (schematic representation is given in annex B);
- Bed layout machine (schematic representation is given in annex C);
- Strand pushing/pulling machine (schematic representation is given in annex D);
- Spinner, extruder, vibrodistributor (schematic representation is given in annex E);
- Tarpaulin paying out and winding in machine (schematic representation is given in annex F);
- Sawing machine (schematic representation is given in annex G).

NOTE The manufacturing operations include some or all of the following:

- treating pre-stressing bed with release agent;
- "marking out" the elements (slabs, plain slabs, etc.) to be made;
- running the pre-stressing strands;
- pre-tensioning;
- installing the shutterings, (formwork, side shutters, end plates and inserts)
- fixing reinforcement;
- tensioning;
- concrete distribution and compaction;
- winding out the tarpaulin;
- heating;
- detensioning;
- removal of shettering, formwork, etc. ;
- strands cutting or sawing;
- removal of final products;
- bed cleaning.

The concrete supply interface which is taken into account for safety is also considered.

The sequence of these operations can be different according to the manufacturing process used in the factory and to the various types of products.

1.3 This European Standard deals with the significant hazards pertinent to these machines, when they are used as intended under the conditions foreseen by the manufacturer (see clause 4), except noise hazards which are partly dealt with and hazards due to handling the package of cut wires and placing them on beds.

NOTE Amendment is under preparation to deal with noise, in particular for measures to reduce noise at source and a noise test code including noise declaration.

This European Standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards.

EN 12629-7:2004 (E)

1.4 Sub-clause 1.3 of EN 12629-1:2000 applies.

1.5 Sub-clause 1.4 of EN 12629-1:2000 applies.

NOTE At the designing stage, in complement to this standard, other type C standards dealing with similar hazards can be used for some of the machines and equipment mentioned in this standard. EN 13862 for Floor sawing machines or EN 1454 on portable saws can be a help to design the saws described in this standard.

1.6 This document is applicable to equipment for long-line manufacture of pre-stressed product which are manufactured after the date of publication of this document by CEN.

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 (including amendments).

EN 294, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs.*

EN 349:1993, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body.*

EN 457, *Safety of machinery — Auditory danger signals — General requirements, design and testing (ISO 7731:1986, modified).*

EN 811:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs.*

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

EN 953:1997, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards.*

EN 954-1:1996, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design.*

EN 982, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics.*

EN 1050:1996, *Safety of machinery — Principles for risk assessment.*

EN 1070:1998, *Safety of machinery — Terminology.*

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

EN 1760-2, *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars.*

EN 13862:2001, *Floor cutting-off machines — Safety.*

EN 12629-1:2000, *Machines for the manufacture of constructional products from concrete and calcium-silicate — Safety — Part 1: Common requirements.*

EN 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:1997).*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60526:1989).*

EN ISO 14122-1, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of a fixed means of access between two levels (ISO 14122-1:2001).*

EN ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and gangways (ISO 14122-2:2001)*.

EN ISO 14122-3, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairways, stepladders and guard-rails (ISO 14122-3:2001)*.

prEN ISO 14122-4, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO/FDIS 14122-4:2002)*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1070:1998 and EN 12629-1:2000 apply.

Additional definitions specifically needed for this European Standard are added below:

3.1 Products

3.1.1

hollow core flooring slab

pre-stressed slabs incorporating longitudinal hole used in the construction of floors. They are considered as structural elements

3.1.2

beam

pre-stressed concrete element used in building or bridge structures. It has a supporting function; their section can be that of an I, T, Y, U, Π a rectangle, a trapezium, etc.

3.1.3

joist

pre-stressed concrete element forming the supporting part of complex flooring. Its inverted T-shape section provides a support for infill blocks or slabs and in-situ concrete screed (compression slab)

3.1.4

lintel

part constructed of pre-stressed concrete, prismatic in shape with a generally rectangular section. It forms the top part of openings in walls and ensure support for masonry mounted above

3.1.5

plain slab

thin pre-stressed concrete elements designed to form the reinforced section of complex flooring. The compression slab is cast in situ

3.1.6

transmission line pole

pre-stressed concrete post designed to support overhead electric energy or communication cables

3.1.7

lighting column

rectilinear pre-stressed concrete post, designed to support public lighting (streets, parks, sports grounds, etc.)

3.1.8

railway sleeper

trapezium-shaped element of pre-stressed concrete designed to support the rails and maintain them at the required gauge

3.2 Equipment

NOTE There is no customary term for the machines dealt with in this standard. The term featured in the title is merely one of the more frequent terms, but other equivalent terms may be encountered, each combining the words in the following lists in a variety of ways:

production	machines	for the long line manufacture of	pre-stressed	hollow core flooring slab
manufacturing	workshop			plain slabs
	Hall			floor joists

In addition, annex H (informative) gives a trilingual list of terms relative to pre-stressing manufacturing products and equipment.

3.2.1 pre-stressing bed

3.2.1.1 pre-stressing bed for flat products

installation composed of two solid anchor blocks, and a slab connecting the two anchor blocs. The bed may incorporate a steel plate soffit on which concrete products (pre-slabs, joists, hollow slabs) are cast. At the ends of the bed, the blocks are provided with posts and anchor plates (abutment). Jacking devices allow tensioning and detensioning of wires or strands.

NOTE 1 The length of the slab is generally between 40 m and 150 m and the width is between 1,20 m and 2,40 m.

NOTE 2 The pre-stressing bed used for the manufacture of flat products is usually completed by rails arranged on both sides of the slab. The rails are intended to guide mobile machines."

3.2.1.2 pre-stressing bed for beam type products

installation composed of two solid anchor blocks, a slab connecting the two anchor blocs and two walls, generally movable. At the ends of the bed, the blocks are provided with posts and anchor plates (abutment). Jacking devices allow tensioning and detensioning of wires or strands.

NOTE 1 The length of the bed is generally between 80 m and 100 m and the width is between 0,50 m and 2 m.

NOTE 2 The beds may be single or double (parallel casting of two beams).

3.2.2 self stressing bed

structure enclosing or supporting shutterings and simply resting on the ground or on suitable supports. The length of this structure is between several meters (depending on the manufactured products) and a maximum size compatible with the overall stability and the forces developed by the tension in the strands

3.2.3 heating equipment

equipment intended to harden the products

NOTE heating equipment includes:

- a type of energy sources from:
 - electricity;
 - "free" steam;
 - steam or hot fluids in a closed circuit;
 - hot air
- and a heating system from:
 - heating soffits or heating elements under moulds or shuttering;
 - electric heating cable integrated into the bed;
 - heated tarpaulin;
 - heated shuttering or mould.

3.2.4 tensioning and tension relieving equipment

3.2.4.1 single strand tensioning

equipment consisting of a jacking device and its associated hydraulic machine (which is generally mobile) which supplies the energy needed to tension the strands: wire or strands. The jacking device takes its support on the

anchorage utilising a barrel and conical wedge ensuring the restraint of pre-stressed reinforcement. The strands are anchored on the anchorage abutment

3.2.4.2

multi-strand tensioning

equipment allowing the simultaneous tensioning of all the strands on one bed. The anchor points in the transverse anchor are obtained by anchor grips or button-heads; the button-heads are made by cold forming the wire ends. The pre-stressing bed has a transverse anchor at either end. At one end, the transverse anchor is fixed and at the other is mobile and moved by hydraulic cylinders. A fixed hydraulic machine supplies the necessary energy.

After tensioning, the cylinders are locked in position by a mechanical device (support, auger) so that they do not stay under pressure during the following operations

3.2.4.3

detensioning

operation where, at first, the jacking devices are put under pressure slightly above the tensioning pressure to release the locking device (screw, support, etc.). Then, they act as a brake to release the tension in the strands (progressive release).

In the case of wide beds or asymmetry in the forces in the strands, a guiding and balancing device can be set up

3.2.5

concrete casting machines

3.2.5.1

vibrodistributor

independent mobile machine providing the uniform distribution of concrete (in general for the manufacture of plain slabs or joists) compacting and controlling the concrete thickness by means of vibration.

Generally, vibrodistributors incorporate auxiliary systems that allow to carry out the roughness of the upper face for plain slabs

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3.2.5.2

sheer compactor and extruder

mobile automatic machine that distributes the concrete while forming (generally for the manufacture of hollow core flooring slabs and joists), compacting and finishing the product. These operations are generally carried out using the principle of a vibrating and sliding core.

The machine can be moved under its own power (sheer compactor) or by reaction due to the thrust against the concrete applied during the feed (sheer compaction)

3.2.6

auxiliary machines

3.2.6.1

bed cleaning machine

independent moving carriage assemblies, towed or self-propelled to ensure:

- the sweeping the soffit or moulds;
- the removal of hardened concrete;
- the spraying of release agents onto the soffit or moulds.

In some cases, they locate the pre-stressing strands.

3.2.6.2

marking out machine

independent machine consisting of self-propelled mobile carriages designed to ensure the layout of product in terms of dimension and shape. Generally they are used for the manufacture of floor shuttering slabs

3.2.6.3

machine for laying and removing block ends

independent towed or self-propelled mobile carriage machines to handle, store, install and remove inserts (also called combs) to install and remove them. These machines are used to manufacture the floor joist and plain slabs. They ensure their set up and their withdrawal

3.2.6.4

strand pulling machine

self-propelled carriages, or machines propelled by other means, travelling sidewise or over the bed and, in their movements, pulling one or several strands in such a fashion as to cut them to length.

The strands are available in coils. They are held in dispensers or turntables

3.2.6.5

strand pushing machine

machine situated on the side of the beds and pushing each strand in a casing all along the beds, cutting them automatically to the desired length. When the desired number of strands has been cut, the casing opens and releases the strands on the side of the bed.

The strands are then pulled on the bed

3.2.6.6

strands setting up machine

independent or towed mobile carriages used for positioning the pre-stressing strands on the bed.

These strands are generally stored in coils or are pre-cut.

Some similar machines can set down or fix the passive transverse reinforcement. This equipment is more specifically used in the manufacture of plain slabs

3.2.6.7

tarpaulin paying out machine

independent or towed mobile carriage carrying a tarpaulin pay out drum. For movement in a given direction, the tarpaulin is rolled out over the product to be heated; for a movement in the opposite direction, it is wound in and thus uncovers the hardened products. These operations can be mechanised or manual

3.2.6.8

bed sawing machine

independent or towed mobile carriage which includes a concrete or strand sawing. Depending upon its orientation, sawing can be longitudinal, transverse or angled. Some of the carriages can be programmed to automatically execute all the cuts for a bed

3.2.6.9

concrete vacuum machines

independent or towed mobile carriage which includes a vacuum device to remove green concrete spillage (between two products)

4 List of significant hazards

This clause contains the hazards, hazardous situations, as far as they are dealt with in this European Standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce risk.

Before using this standard, it is important for the manufacturer to carry out a risk assessment of the various machines which are covered by this standard to check that they have the hazards identified in this clause.

Annexes A to G (informative) illustrate examples of the following common machine types:

- pre-stressing bed, strands setting up machine, fixed or mobile tensioning equipment and self stressing bed;
- sweeper/vacuum machine/oiler;
- bed layout machine;
- strand pulling/pushing machine;
- sheer compactor, extruder, vibrodistributor;
- tarpaulin paying out and winding in machine;
- strand and concrete sawing machine.

In accordance with clause 4 of EN 12629-1:2000 the hazard zones described in the following tables are illustrated in annexes A to G.

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Table 1 — Pre-stressing bed, strands setting up machine, fixed or mobile tensioning equipment and self stressing bed

Ref	Hazard according to annex A of EN 1050:1996	Localisation/scenario	See Figures A.1 and A.3
1	Mechanical hazards		
1.1	Crushing	detensioning cylinders, jacking devices releasing	1
		falling of the single wire stressing jack	3
1.2	Shearing	between button-heads and transverse anchor (during pre-tensioning)	4
		with the bed accessories (removable walls, mobile vibrator)	5
		with the mobile part of the single wire stressing jack during tensioning	6
1.3	Cutting	sharp edges in beds and casing	7
1.4	Drawing-in or trapping	strands (wire or bundles) under tension (failure of the anchoring, slippage of the locking device)	8
		by strands (wire or bundles) during setting up	9
1.5	Impact	strands (wire or bundles) under tension (failure of the anchoring, slippage of the locking device)	8
		by strands (wire or bundles) during setting up	9
		chain or guard ejection due to rupture of strands (wire or bundles)	2
		falling of the end bed mobile guard (mobile cover, shield, grid)	10
		falling of accessories (combs, inserts, layout of product sides and ends) during mechanical or manual handling operations	8
		rupture of a transverse anchor	4
1.6	Ejection of fluids under pressure	hoses under hydraulic pressure, hot fluids of the hydraulic circuits, feeding of the cylinders for tensioning of reinforcements	11
		steam pipes, valves: breaking, leakage	12
1.7	Ejection of parts	chain or guard ejection due to rupture of strands (wire or bundles)	2
		rupture of the pneumatic rope of the bed vibrator	13
1.8	Slip, trip and falling	oiled beds (walking on the beds after spraying of the releasing agents)	8
		rails on both sides of the bed that constitute obstacles for the passage and falling from a height	14
		machine ends, hydraulic pipes on the ground	14
		falling into the tensioning hole	15
		falling from/into the casing (assembly of the reinforcements, concrete smoothing...)	5
2	Electrical hazard		
2.1	Electrical contacts (direct or indirect)	motor, branch boxes, electrical resistances under the beds, plugs	13-16
3	Thermal hazards		
3.1	Burns	heat radiation from the bed (heating of the beds): feet burns	8
		steam pipes (location, isolation, leakage)	8-12
4	Hazards generated by noise		
4.1	Hearing losses (deafness)	hydraulic groups of the tensioning cylinders of strands (wire or strands)	16
		fix and mobile vibrators on vibratory bed, poker vibrator	13

Table 1 (continued)

Ref	Hazard according to annex A of EN 1050:1996	Localisation/scenario	See Figures A.1 and A.3
5	Hazards generated by vibration		
5.1	Neurological and vascular disorders	contact with vibrating bed and/or moulds (direct vibration by poker vibrators, vibrating beams, fixed or mobile vibrators)	13
6	Hazards generated by materials and products		
6.1	Contact or inhalation of dangerous mist, oil, fluids, gas, fumes, dusts	releasing agents (contact and inhalation during spraying on the bed)	8-13
		hydraulic fluids (tensioning equipment, cylinders)	16
6.2	Contact with harmful products	contact with green concrete (cement caused affections)	8-13
		cleaning products of the transverse anchor	4
6.3	Fire	releasing and hydraulic oil	8-13-16
		electrical groups (hydraulic group, control of the heating of the beds)	13-16
		cleaning products of the transverse anchor	4
6.4	Perforation, puncture	Ends of strands (breaking of reinforcement or button-holding, or button-heads slipping in the anchors)	4
		transverse anchor disengagement after cutting of the steel	4
		breaking of the strand or wire (damaged wires or short length)	8-3
7	Hazards generated by neglecting ergonomic principles in machine design		
7.1	Unhealthy postures	location of the tensioning and tension relieving equipment for single strand compared to the tensioned wires and to the manometer	16
		location of the controls of the hydraulic equipment compared to the bed	16
		access to the tensioning holes	15
7.2	Excessive efforts	tensioning by single wire cylinder (height, support of the single wire stressing jack)	3
7.3	Inadequacy with human anatomy	low position of the beds and height of the casings during manufacturing, cleaning and handling operations (curved back or tilted in the casing)	8-13
		lack of opening of the beds to facilitate the reinforcements mounting (posts, beams)	13
7.4	Neglecting use of personal protective equipment	lack of advice, written instructions, PPE adapted to human (glasses, gloves, sound protection)	3-8-13
		initial training of the personnel	2-9
7.6	Human error	not respecting the order of tensioning the wires (breaking risks)	3
		non-stop of the tensioning at the indications provided on the bed or on the manometer (breaking of the steels and of the equipment)	8
		additional traction on the strand (several tensioning strokes with the single wire stressing jack)= risk of breaking of the wire	3
		assembling of the pins (mixing of new, old, different... parts), forget to clean and to check	4
8	Hazards generated by failure of energy and other malfunctions		
8.1	Failure of control system	failure of the hydraulic balancing of the multi-strand tensioning cylinders: mechanical break	1
8.2	Errors of fitting	inverting the tensioning equipment hydraulic ropes	11